Filed IN SA Vol # 3

JANUARY 1990

PRELIMINARY ASSESSMENT REPORT

FOR SITE 16

AREA "M" OUTFALL DITCH

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
McGREGOR, TX 76657

EPA
IDENTIFICATION: TX 9170024708

McGregor Naval Weapons
TX9170024708

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, S. C. 29411

SUPERFUND FILE

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NWIRP (Hercules Inc., Hunt)

PRELIMINARY ASSESSMENT REPORT FOR SITE 16

ACTIVITY NAME: NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
ADDRESS: P. O. BOX 548, MCGREGOR, TX 76657

UIC: N95918

EPA REGION: 6

EPA IDENTIFICATION: TX9170024708

LATITUDE: 31 -25'-0" LONGITUDE: 97 -25'-0"

PRELIMINARY ASSESSMENT MEMBER
ROBERT W. MOSER

PREPARED BY:
SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON, SC 29411
JANUARY 1990

PRIORITY FOR SITE INSPECTION: MEDIUM

Waste silver has been detected in the soils of a drainage ditch. This site is the sixteen potentially contaminated site identified at the plant. The site is recommended to undergo a removal action prior to site inspection. In March 1983 the Naval Energy and Environmental Support Activity of Port Hueneme, California reported fourteen potentially contaminated sites in the Initial Assessment Study of Naval Weapons Industrial Reserve Plant, McGregor, Texas, NEESA 13-006. Seven of the fourteen sites were recommended for confirmation study (site investigation). Southern Division Naval Facilities Engineering Command reported the finding of the confirmation study which recommended only three sites for remedial action in the NACIP Confirmation Study and Summary of Remedial Action, Naval Weapons Industrial Reserve Plant, McGregor, Texas dated August 1983. Two of the three sites have been remediated and the third is being resolved by a third party through a civil action. Site 2, Area F-west settlin ponds and site 6, Area L-asbestos pile has been remediated. Site 5, Area G-pesticide dump is being remediated by a third party. Site 15, Area G pesticide contamination outside of building 704, is being investigated by a third party.

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LAB RESULTS

1.0. ACTIVITY DESCRIPTION

1.1. INTRODUCTION

Section 211 of Superfund Amendments and Reauthorization Act of 1986 (SARA 211) provides continued authority for the Department of Defense Environmental Restoration Account (DERA). The Naval Installation Restoration (IR) program is authorized by Chief of Naval Operations Instruction (OPNAVINST) 5090.1 of 26 May 1983. The Naval Facilities Engineering Command (NAVFACENGCOM) manages the Navy program. SOUTHNAVFACENGCOM conducted the Preliminary Assessment (PA) since this was a single site and Naval Energy and Environmental Support Activity (NEESA) had already conducted the Initial Assessment Study (IAS) as required by law, in March 1983, which also meet SARA PA 120 requirements.

PAs are conducted in accordance with Environmental Protection Agency (EPA) draft guidance on "Pre-Remedial Activities at Federal Facilities" forwarded by EPA memorandum of 8 September 1987. PA recommendations are consistent with the National Contingency Plan.

The PA begins with investigation and review of available records from the Activity, NEESA and the cognizant NAVFACENGCOM Engineering Field Division. After record search, the PA member visits the activity to complete documentation of past and present operations and disposal practices with the assistance of the activity point of contact, the member tours the activity and interviews long term employees. If a potential threat to human health or the environment is present, further action is recommended. Possible recommendations for further action may include Site Inspection, Remedial Investigation, or Removal Action.

Section 1.0 is taken from the Initial Assessment Study for Naval Weapons Industrial Reserve Plant (NWIRP), McGregor, Texas dated 1983. The purpose of the IAS was to systematically identify, assess, and control contaminates in the environment resulting from past hazardous material management operations. For the most part, the text is repeated verbatum from the IAS.

1.2. ACTIVITY LOCATION

The Naval Weapons Industrial Reserve Plant (NWIRP) is a government owned facility operated by Hercules Inc. The plant is situated on an irregularly shaped tract of land lying mostly in McLennan County with a small portion of the western parcel in Coryell County, Texas. The site is located approximately 20 miles southwest of Waco, as shown in Figure 1-1. The town of McGregor adjoins the facility at the northeast corner and has a population of about 4,500 persons. The plant is bordered by the St. Louis and Southwestern Railroad on the north and the Gulf, Colorado and Santa Fe to the east. The main entrance is located on Johnson Drive off U.S. 84. State Highway 317 runs along the eastern edge of the plant and FM 2671 along a major portion of the southern boundary.

This portion of Texas is primarily an agricultural area. Land bordering the east side of NWIRP is zoned as residential property; the south boundary, classified commercial, has light manufacturing operations and a university

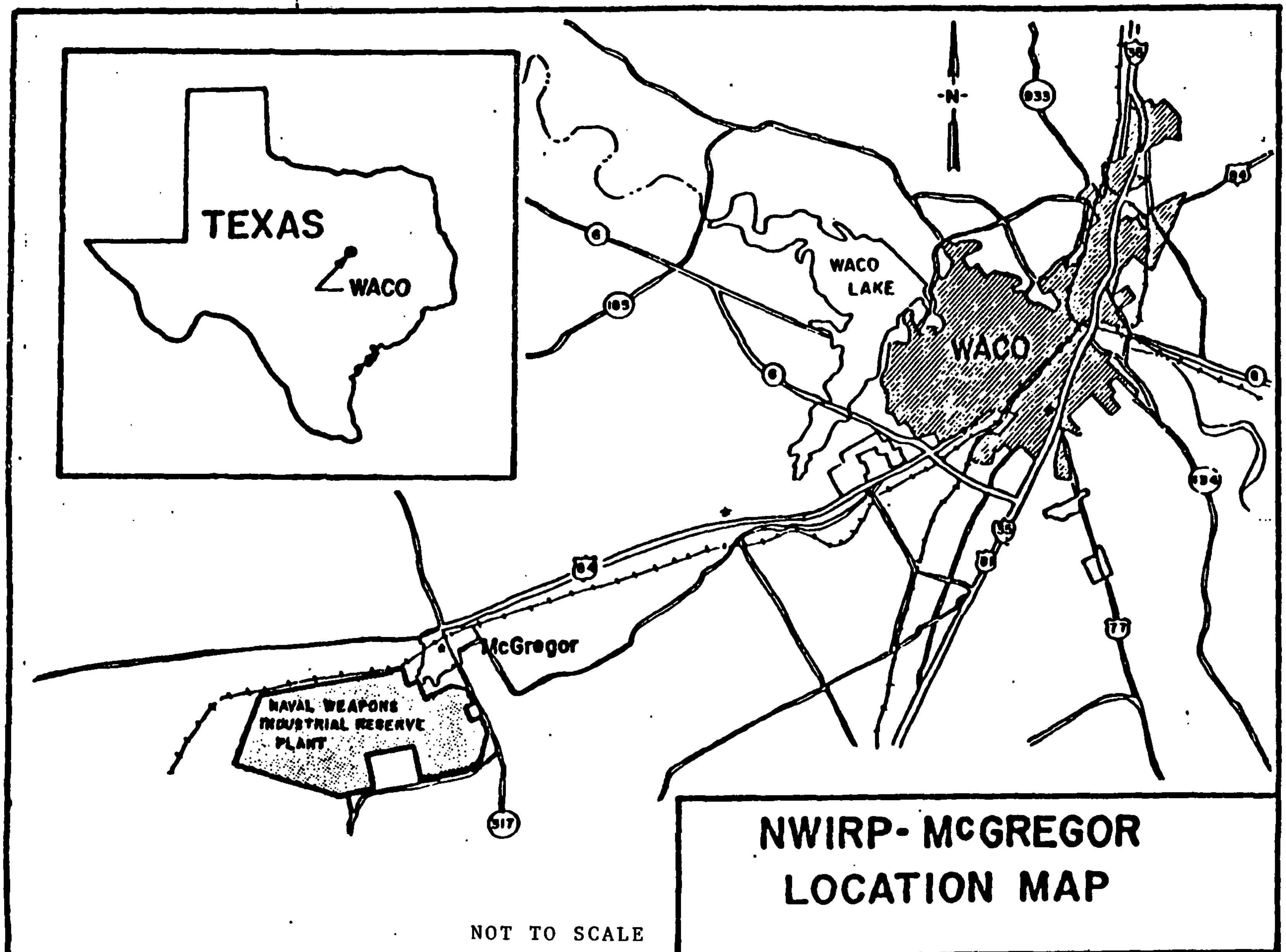

TEXAS
WACO
WACO LAKE
WACO
N
McGregor
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
NOT TO SCALE
NWIRP- McGREGOR
LOCATION MAP

FIGURE 1-1

research center; and the remainder, as open farming and grazing land, is only sparsely populated.

1.3. SITE LOCATION

In 1963 the west end of Area 'M' was developed to house the nondestructive testing equipment, Figure 1-2. The site consist of building 1228, earthen berm, fencing, septic tank and an outfall ditch as shown on Figure 1-3. Site 16 is the outfall ditch.

1.4. CLIMATOLOGY

The NWIRP-McGregor site has a humid subtropical continental climate. Summers are long with high temperatures, while winters are short and mild. In the six winter months (November through April), the average low temperature is 44.2 degrees Fahrenheit (F) and the average high temperature is 65.7 degrees F. For the six summer months the average low is 68.7 degrees F and the average high is 89.9 degrees F. The average daily temperature is 67.1 degree F. See Table 1-1 for a summary of climatological data.

The amount of precipitation in any one year is extremely variable. Most rainfall is the result of thunderstorm activity; consequently, considerable spatial variation in amounts occurs. There is an average of 77 days per year with precipitation, but much of the precipitation in any one year is concentrated in just a few thunderstorms. For example, in 1979 the yearly precipitation was 42.37 inches, and of this amount 20.26 inches, or 58.90 percent of the total annual precipitation, occurred in twelve days. Total annual rainfall has ranged from 60.20 inches (1905) to only 13.30 inches (1917), with the average annual precipitation being 31.26 inches. April and May are normally the wettest months, with July and August being the driest. There is no appreciable amount of snowfall in the area.

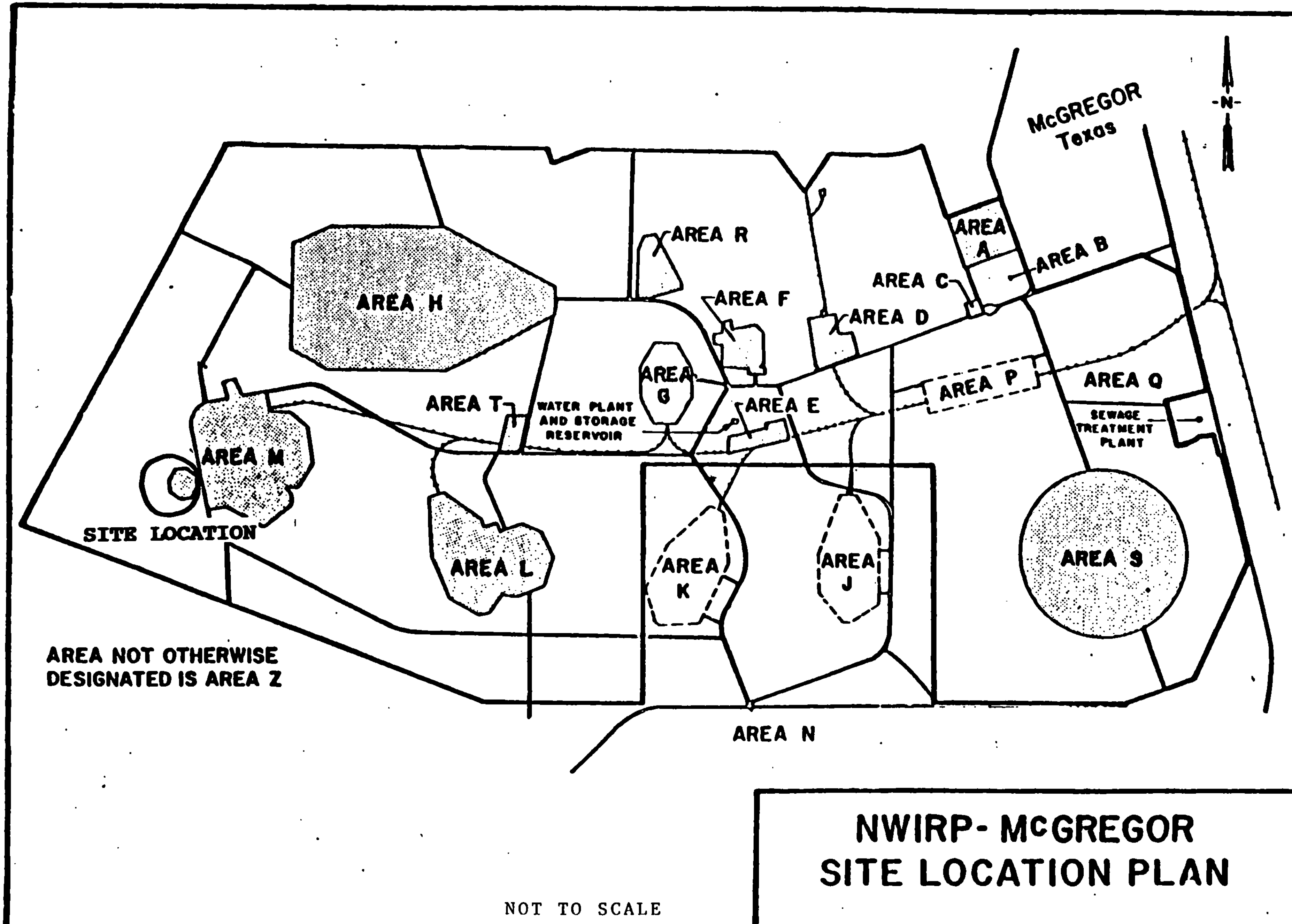
Evaporation rates are high in relation to annual precipitation. For example, in 1980 the pan evaporation rates for March through November totalled 81.7 inches compared to the average annual precipitation of only 31.26 inches. Much of the precipitation is evaporated which serves to reduce the possibility of leachate production and contamination migration.

The average relative humidity is 66.8 percent. Prevailing wind direction is from the south throughout the year.

1.5. TOPOGRAPHY

The NWIRP-McGregor site is situated in the Cretaceous Prairie region of north central Texas. The Cretaceous Prairie is further divided into two great phsiographic prairies: the Blackland Prairie, and the Grand Prairie. The chief difference between these two pariries is that the Grand Prairie has developed on firm resistent limestone, and the Blackland Prairie has developed on much less resistent clays and shales.

The NWIRP-McGregor site is located in the eastern most portion of the Grand Prairie, with the Blackland Prairie located to the south and east. In general, the surface of the Grand Prairie is composed of gently sloping, almost level, dip plains, broken only by the drainageways. The Grand Prairie



NWIRP- McGREGOR
SITE LOCATION PLAN

FIGURE 1-2

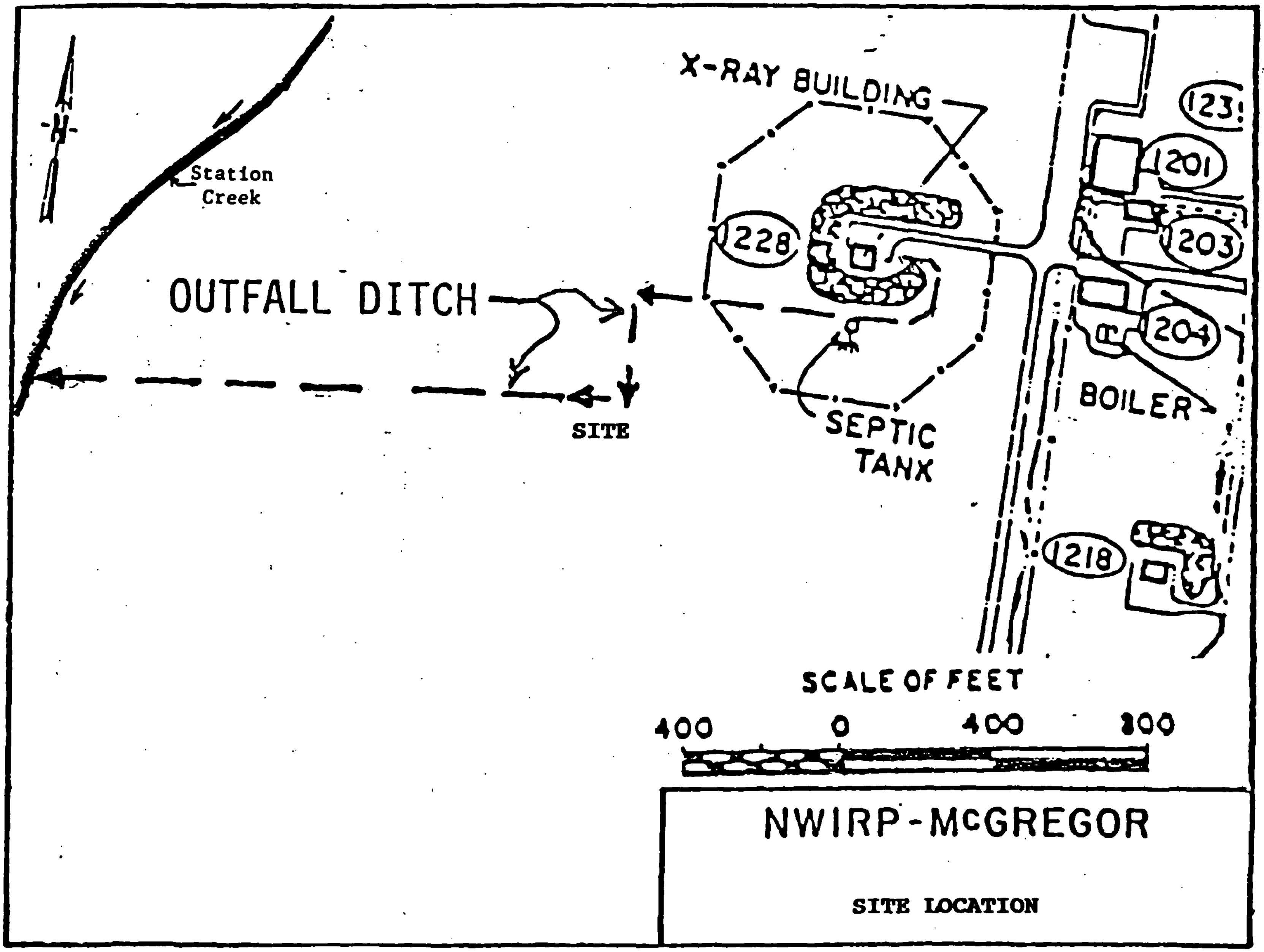

N
Station Creek
OUTFALL DITCH
SITE
X-RAY BUILDING
1228
SEPTIC TANK
1235
1201
1203
1204
BOILER
1218
SCALE OF FEET
400 0 400 800
NWIRP-McGREGOR
SITE LOCATION

FIGURE 1-3

TABLE 1-1

SUMMARY OF CLIMATOLOGICAL DATA

Months	Temperature (°F) Normal Daily Max.	Temperature (°F) Normal Daily Min.	Temperature (°F) Normal Monthly	Temperature (°F) Extremes Record Highest	Temperature (°F) Extremes Record Lowest	Precipitation (Inches) Normal	Precipitation (Inches) Maximum Monthly	Precipitation (Inches) Minimum Monthly	Precipitation (Inches) Max. in 24-hr	Relative Humidity (%)	Wind Mean Speed (mph)	Wind Prevailing Direction	Mean Number of Days Precip. (0.01 inch or more)	Mean Number of Days Thunderstorms	Mean Number of Days 90°F & Above	Mean Number of Days 32°F & Below
(a)				37	37		37	31	37	16	30	14	36	36	16	16
Jan	57.4	36.6	47.0	88	-5	1.87	5.83	0.03	2.24	71.25	11.9	S	7	1	0	14
Feb	61.5	40.3	50.9	90	5	2.38	4.55	0.17	3.03	68.25	12.2	S	7	2	0	8
Mar	68.4	46.0	57.2	100	15	2.36	6.84	0.04	3.07	65.5	13.3	S	7	4	1	2
Apr	77.8	56.8	67.3	101	27	4.02	13.37	0.65	5.09	69.25	11.2	S	8	6	1	0
May	84.4	64.5	74.5	99	45	4.60	15.00	0.72	7.18	71.0	12.1	S	9	8	6	0
Jun	91.9	71.8	81.9	104	52	2.73	12.06	0.27	4.21	64.75	11.8	S	6	5	22	0
Jul	96.2	75.0	85.6	108	61	1.47	8.58	T	4.49	59.0	10.8	S	4	4	28	0
Aug	96.7	74.7	85.7	112	60	1.81	8.91	T	4.80	60.75	9.9	S	5	5	28	0
Sep	89.5	68.3	78.9	106	48	3.19	7.29	0	4.57	61.5	9.5	S	6	4	15	0
Oct	80.4	57.7	69.1	101	32	2.55	9.36	0	5.72	67.25	10.0	S	5	3	3	0
Nov	68.7	46.2	57.5	92	17	2.27	6.24	0.11	4.26	69.25	10.9	S	6	2	0	2
Dec	60.6	39.1	49.8	91	14	2.01	7.03	0.04	3.11	69.5	11.3	S	6	1	0	9
Year	77.0	56.8	67.1	112	-5	31.26	15.00	0	7.18	66.75	11.4	S	77	45	104	35

NOTES: (a) Length of record (years).

is a hard-rock prairie underlain mainly by limestone of the Washita Group, and the area is also referred to as the Washita Prairie. The Grand Prairie is characterized by shallow calcareous soils.

The suraface features, or landscape, of the NWIRP-McGregor site roughly parallels the underlying bedrock. The topography of the site is gently undulating with slopes ranging from nearly level to five percent. Drainage for the site is provided by tributaries of Harris Creek, Station Creek, and the South Bosque River. All of the streams within the site's boundary are intermittent.

1.6. GEOLOGY

Table 1-2 shows the geologic units which occur in central Texas. A geologic section of the area is shown in Figure 1-4. The geologic units within the boundary of the NWIRP-McGregor site is Comanchean series. The Comanchean series is divided into three groups form the oldest to the youngest; the Trinity group, the Fredricksburg group, and the Washita group. Only the Washita group crops out in the vicinity of the NWIRP-McGregor site.

The Georgetown formation (Table 1-2) is the only formation which makes up the Washita group out crop at the site. The Georgetown formation is divided into seven units from the oldest to the youngest: Kiamichi, Duck Creek, Fort Worth Limestone, Denton Marl, Weno Limestone, Pawpaw Shale, and Main Street Limestone. The two oldest units, Kiamichi and Duck Creek, do not crop out in the area of the site. The other units of the Georgetown formation do crop out within the boundary of the site. Figure 1-5 shows the geologic outcrop pattern at the site. Figure 5-5 of the Initial Assessment Study has the original map.

1.6.1. FORT WORTH LIMESTONE - (KDFDEE) The Fort Worth Limestone is twenty-two feet thick in the McGregor Quadrangle (IAS, 1983). It consists of fairly uniform, nodular limestone with interbedded thin shale layers. The Forth Worth Limestone crops out in only one small area at the site, just southeast of Area 'M'.

1.6.2. DENTON MARL - (KDFDEE) The Denton Marl is approximately six feet thick in the McGregor Quadrangle (IAS, 1983). It is composed of dark gray soft marl which has several discontinuous thin limestone ledges near the center. The Denton Marl crops out in one isolated area southeast of Area 'M'.

1.6.3. WENO LIMESTONE - (KPW) The Weno Limestone in the McGregor Quadrangle is approximately thrity-six feet thick (IAS, 1983). The upper seventeen feet consist of nodular, bedded limestone with alternating thin marl beds. The lower nineteen feet have several unconsolidated marl beds. The base of the Weno Limestone is a very resistant limestone ledge known as at the Ocee ledge and is easily differentiated from the underlying Denton formation. The Weno Limestone is the second most frequently occurring outcrop near the site, Area 'M'.

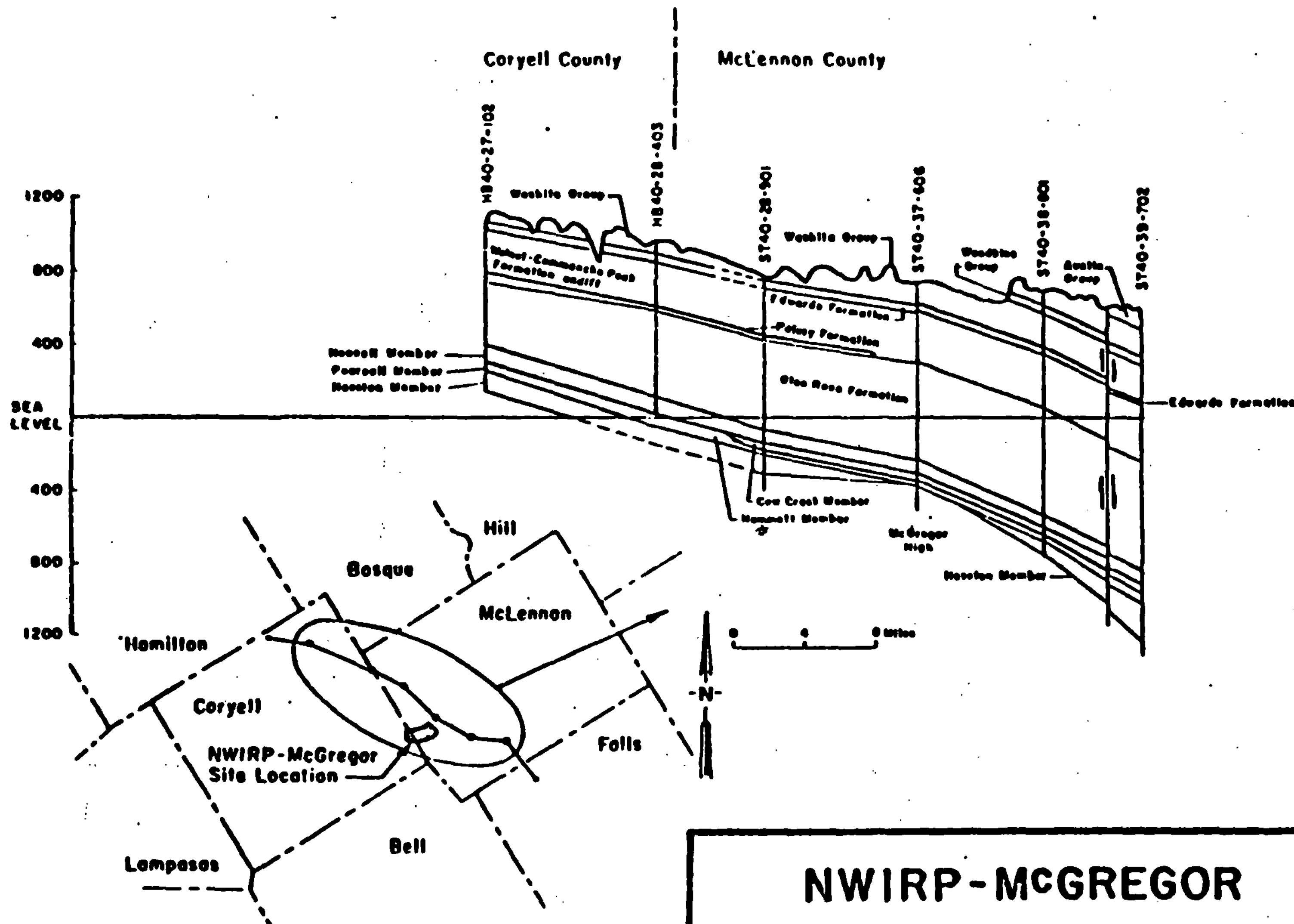
1.6.4. PAWPAW SHALE - (KPW) The Pawpaw Shale bed is seven feet thick in the McGregor Quadrangle (IAS, 1983). The Pawpaw Shale unit weathers into three zones. The top and bottom two feet contain marly limestone that is easily weathered, while the middle three feet weather less quickly and remain

TABLE 1-2

GEOLOGIC UNITS OF CENTRAL TEXAS

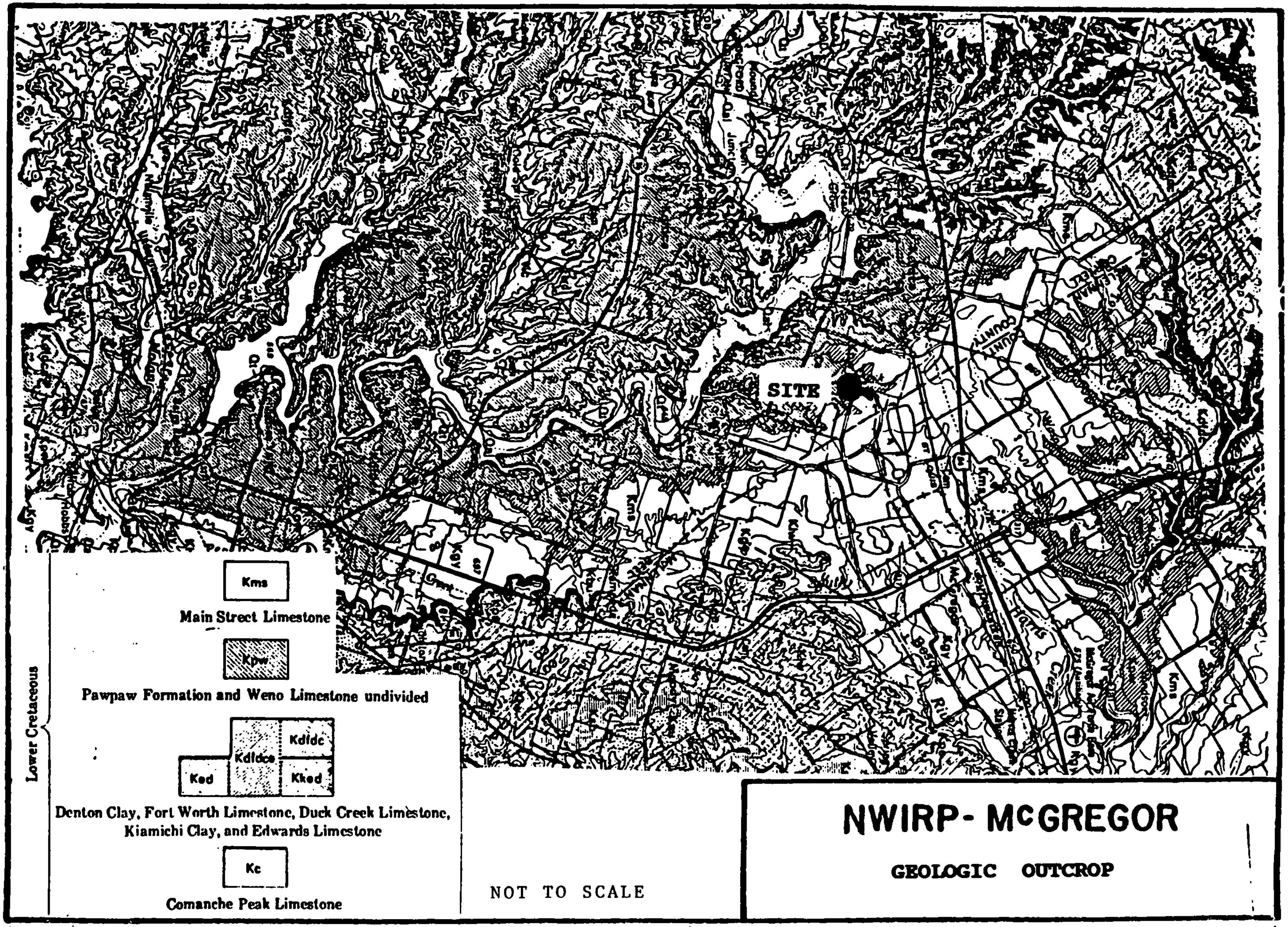
SYSTEM	SERIES	GROUPS	FORMATIONS	THICKNESS (ft)	MEASURED SECTIONS
CRETACEOUS	GULFIAN				
		EAGLE FORD	South Bosque	none	none included
			Lake Waco	55	
			Pepper	45	
	COMANCHEAN	WASHITA	Buda	none	
			Del Rio	45	
			Georgetown: Main Street	35	
			Georgetown: Fawpaw	7	
			Georgetown: Weno	36	
			Georgetown: Denton	6	
			Georgetown: Fort Worth	22	
			Georgetown: Duck Creek	29	
			Georgetown: Kiamichi	4	
		FREDERICKSBURG	Edwards	40	
			Comanche Peak	120	
			Walnut	150	
			Paluxy	20	
			Glen Rose	460	
		TRINITY	Hensel		
			Pearsall		
			Sligo		
			Hosston		

(Thornhill 1980)



NWIRP-McGREGOR GEOLOGIC SECTION

FIGURE 1-4



NWIRP- McGREGOR

GEOLOGIC OUTCROP

FIGURE 1-5

as a resistant ledge. The Pawpaw Shale crops out in isolated areas of Area 'M'.

1.6.5. MAIN STREET LIMESTONE - (KMS) The Main Street Limestone is about thrity-five feet thick in the McGregor Quadrangle (IAS,1983). The Main Street Limestone consists of medium hard, resistent, white, fine to medium crystalline, nodular limestone. The lower limit of the Main Street Limestone is marked by the marly, less resistant beds of the Pawpaw Shale member. The Main Street Limestone mostly out crops in Area 'M'.

Upon weathering, all the out cropping units of the Georgetown formation, exclusive of the Main Street Limestone, which is already hard and impermeable, become impermeable (IAS, 1983). This is a result of the clays in these units which are released during weathering. These clays form an effective seal to downward percolation of water.

The geologic formations underlying the site are relatively flat. These beds have a dip of twenty to twenty-five feet per mile to the southeast and a strike of north 6 degrees (IAS, 1983).

1.7. SOILS

The soils of the Grand Prairie, in which the site is located, are residual soils which have developed from the underlying limestones and marl. The soils of the site are characterized by a mixture of deep and shallow clays on limestone. The dominant soils are dark reddish-brown to dark-brown clays of the Crawford Series and Purves Series. These soils can be classified as vertisols, and expand and contract in relation to the soil moisture. When wet, the clay content of these soils provide a fairly impermeable barrier to downward leaching. However, when these soils dry out, they develop vertical cracks which could extend to the shallow underlying bedrock. The depth of soil over the bedrock is variable, but seldom exceeds five or six feet. Figure 1-6 represents a soil map of the site.

1.7.1. CRAWFORD SERIES - (CwB) The Crawford Series is made up of dark-brown to reddish-brown noncalcareous clays. These clays are similar to the Denton soils in many respects, but are finer textured, somewhat less grayish, and usually more reddish in the subsoil. The Crawford Series soils are well drained with slow to medium runoff. They are slightly susceptible to erosion. Permeability of these soils is less than 0.06 inches per hour, which is classified as very slow. However, when dry and cracked the permeability is rapid. The clay content ranges from 40-60 percent. The shrink-swell potential for these soils is rated as very high, meaning a volume change of more than 9 percent is possible.

1.7.2. PURVES SERIES - (PrB) The Purves Series is made up of alkaline, dark-brown gravelly silty clay with limestone fragments. This series of soil is well drained. Permeability is moderately slow. These soils are similar to Crawford Series soils with slow to medium surface runoff. The Purves Series soils are moderately erodible. The surface is sticky when wet and cracks develop when soil becomes dry.

1.8. HYDROLOGY

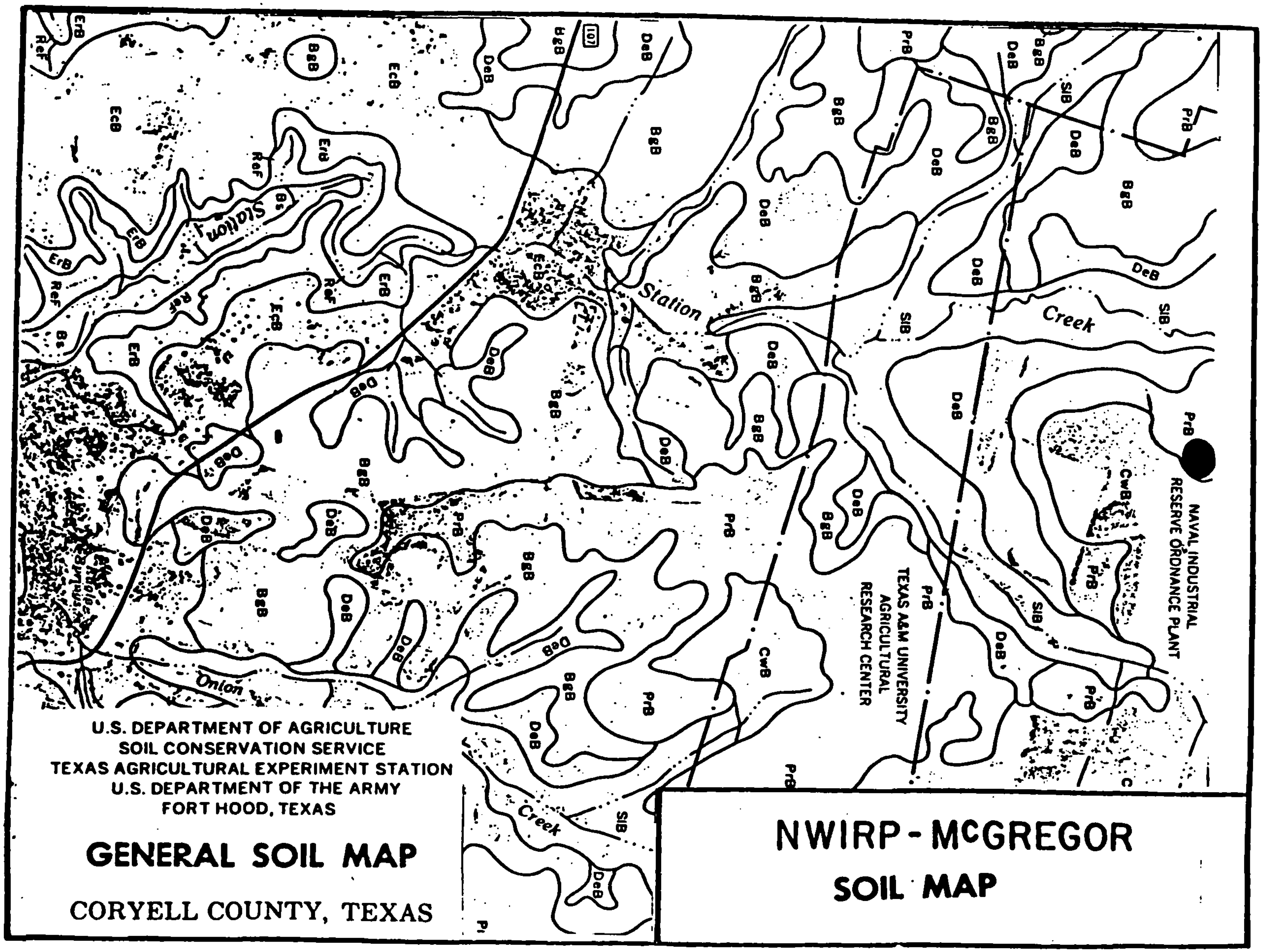

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION
U.S. DEPARTMENT OF THE ARMY
FORT HOOD, TEXAS
GENERAL SOIL MAP
CORYELL COUNTY, TEXAS
NWIRP - McGREGOR
SOIL MAP
NAVAL INDUSTRIAL
RESERVE ORDNANCE PLANT
TEXAS A&M UNIVERSITY
AGRICULTURAL
RESEARCH CENTER
Station Creek
Onion Creek
107
BgB
DeB
PrB
SlB
CwB
EcB
ErB
ReF
Bs

FIGURE 1-6

1.8.1. SURFACE WATER - Surface water at the NWIRP-McGregor site is provided by tributaries of Station Creek, Harris Creek, and the South Bosque River. NWIRP-McGregor is divided into three water shed areas which contribute to the each of the three tributaries. Figure 1-7 shows the watersheds and indicates the direction of surface water flow. All streams within the boundraies of NWIRP-McGregor are intermittent in nature, and are subject to drying up during periods of drought. Many of the tributaries flow only following periods of rain. The flow from the effluent seldoms directly reaches Station Creek. Most of the time, the ditch from 400 feet from the outfall to Station Creek remains dry. Surface water within the boundaries of the site, and in the surrounding areas, are used solely for agricultural purposes, mainly as water for livestock.

Station Creek receives the runoff from watershed on the western portion of NWIRP-McGregor which includes Area 'M'. Drainage from Station Creek flows into the Leon River, which in turn flows into the Bertons Reservoir several miles down stream.

1.8.2. GROUNDWATER - Groundwater is the source for all portable and process water used at the NWIRP-McGregor site, and in the areas surrounding the site. Regionally, much of central Texas relies on groundwater for all or a substantial portion of their drinking and industrial water.

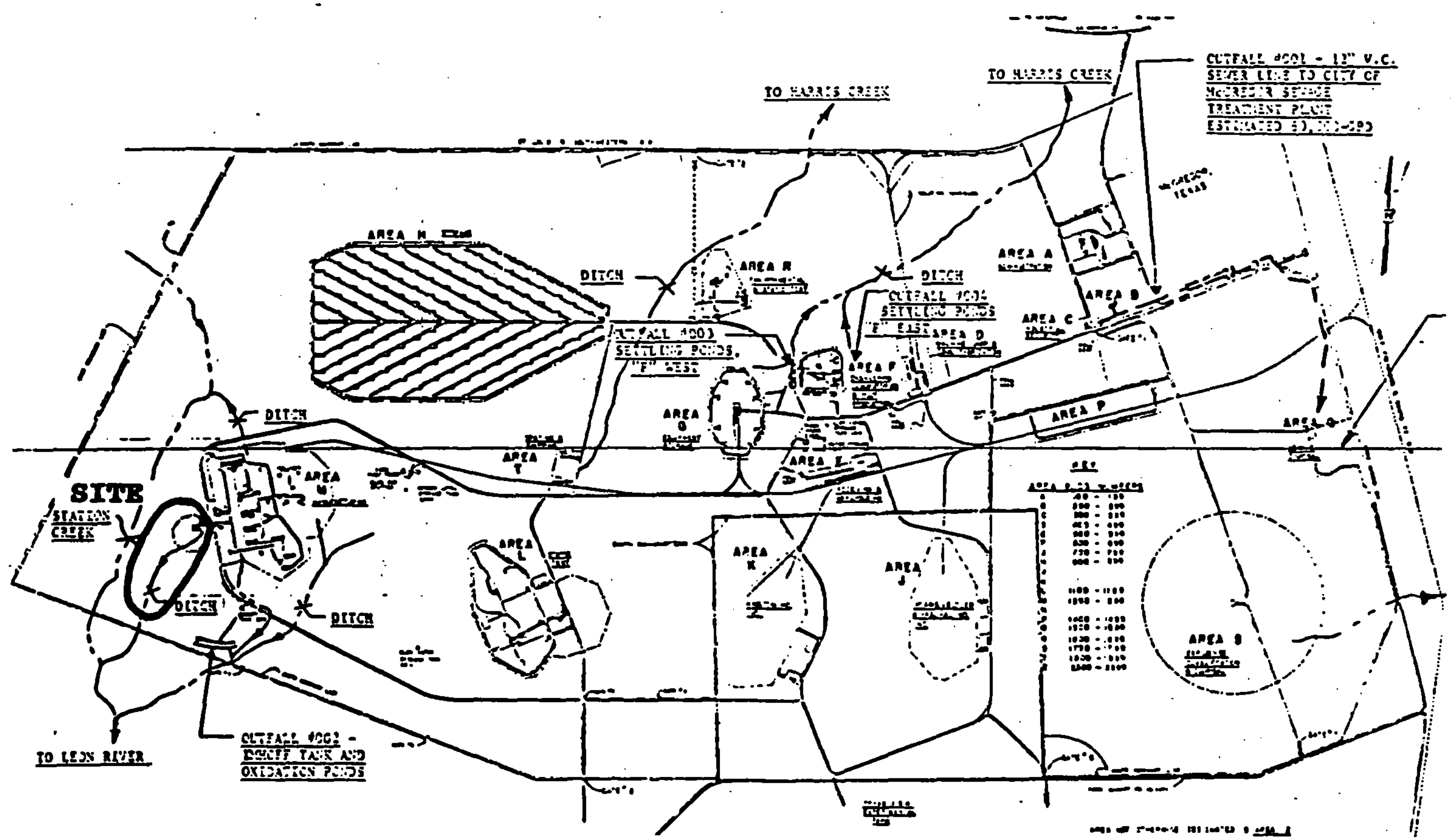
Groundwater in central Texas is obtained from two main aquifers. These aquifers are located within the Trinity division and are known as the Hensel aquifer and the Hosston aquifer. The water in these two aquifers move generally from the northwest to the southwest. The underlyin geology serves to restrict the movement of groundwater through this area in the Hosston aquifer.

The Hensel aquifer is the only available source of groundwater in sufficient quantities for the NWIRP-McGregor site. Most of the surrounding areas access the Hosston aquifer. The Hensel aquifer moves at a rate of 10 to 40 feet per year and has a gradient between 10 to 25 feet. The average transmissibility valve for the Hensel aquifer is 2,000 gallons per day per foot. Permeability value for the Hensel aquifer averages 60 gallons per square foot with an average porosity of 20 to 35 percent. Figure 1-8 is a map showing the location of the wells in the area. Table 1-3 provides relevant data on NWIRP-McGregor four wells.

The upper groundwater flow approximately follows the surface contours. This shallow groundwater occurs in lenses in the upper few feet of the bedrock. The upper groundwater is used solely for agricultural purposes, either for crops or for livestock. The upper groundwater is obtained by shallow hand-dug wells. The water quality is generally poor.

1.9. FLORA AND FAUNA

1.9.1. FLORA - Historically, the area of the NWIRP-McGregor site has been a mid to short grass prairie. Grasses which are common in the area include the following: Buffalo, Hairy grama, Texas grama, Side-oats grama, Three-awn, and Little bluestem. Soils suitable for cultivation have historically been cultivated. Areas where the natural vegetation has been disturbed and subsequently left unattended, usually grow up in Johnson grass



NOT TO SCALE

NWIRP-McGREGOR

WATER SHED MAP

Figure 1-7

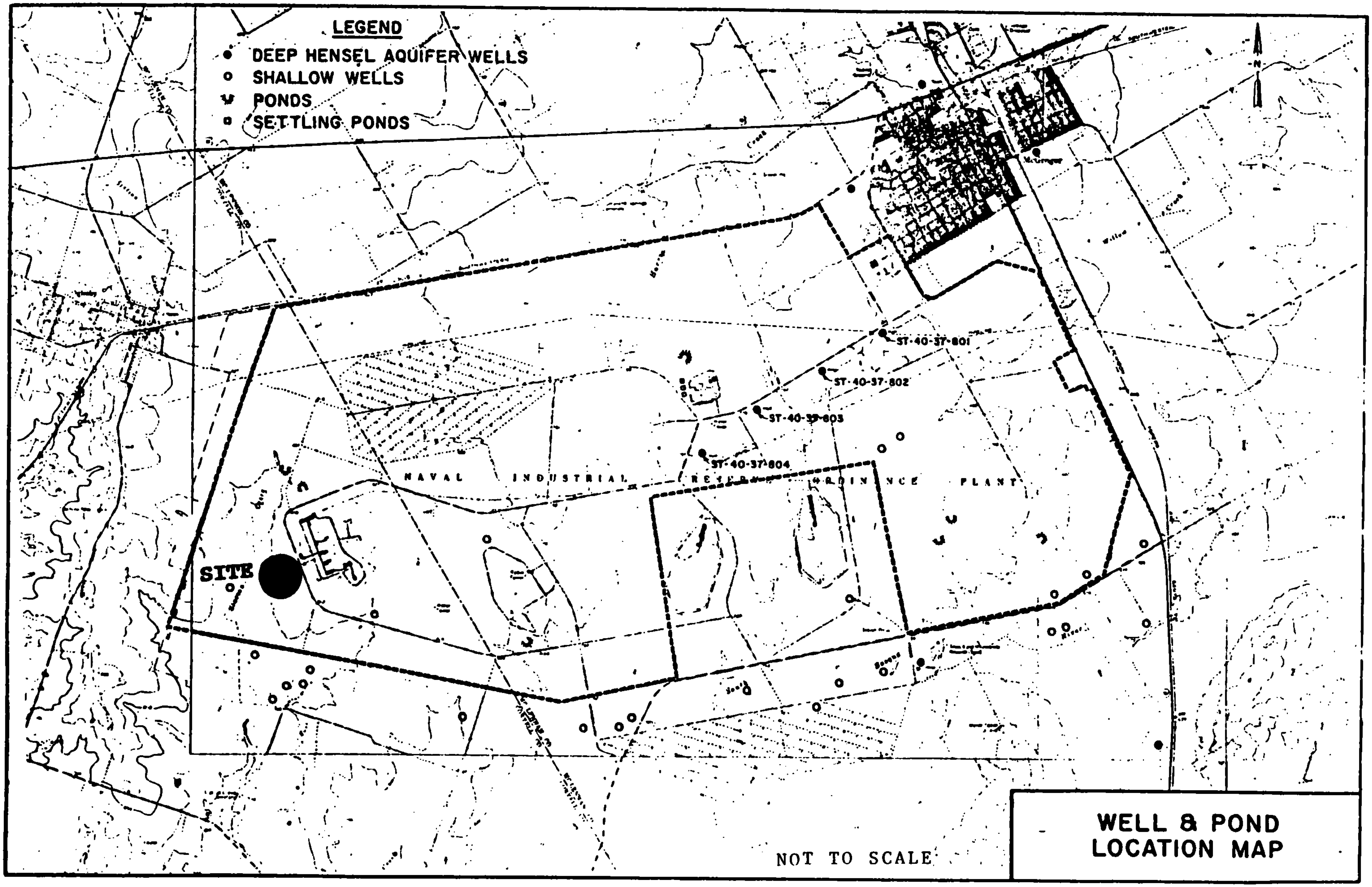

LEGEND
DEEP HENSEL AQUIFER WELLS
SHALLOW WELLS
PONDS
SETTLING PONDS
ST-40-37-801
ST-40-37-802
ST-40-37-803
ST-40-37-804
NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT
SITE
NOT TO SCALE
WELL & POND
LOCATION MAP

FIGURE 1 -8

TABLE 1-3

WELL INFORMATION

		(801) Well 1	(802) Well 2	(803) Well 3	(804) Well 4
Elevation (ft)		744	754	769	781
Measured (gpm)/ Discharge Pressure (ft)	1942	350/-	375/-	240/-	420/-
	1955	350/84	370/51	195/29	430/19.6
	1965	300/85	280/65	200/35	420/18
	1969	370/42	430/51	200/85	570/18
	1977	325/60	430/55	192/21	480/20
	1979	280/50	305/44	206/30	475/20
Static Level (ft)[a]/ Pumping Level (ft)	1942	175/-	216/-	240/-	250/-
	1965	410/610	417/545	-	414/485
	1969	442/638	447/625	480/625	463/547
	1977	493/686	503/660	525/665	528/595
	1979	588/714	552/677	590/743	586/636
Drawdown (ft)/ Specific Capacity (ft)	1965	200/1.6	128/218	-/1.22	71/5.84
	1969	195/1.89	168/2.52	145/1.38	84/6.79
	1977	193/1.68	156/2.79	140/1.37	67/7.16
	1979	126/2.22	125/2.44	153/1.35	70/6.79
Pump Setting (ft)[a]	1942	400	400	440	400
	1955	560	540	560	480
	1957	610	590	620	570
	1969	700	660	680	630
	1979	885	885	820	770
Begin Hensel Aquifer[a]		971	960	962	957
Thickness of Sands (ft)		51	19	30	100
Well Depth (ft)[a]		1,141	1,046	1,011	1,062

NOTE: [a]Depth below surface

and weeds. Along streams and drainagways Hackberry, Bois d'arc, and Willows can occur. Live-oaks are also scattered throughout many areas. Rough stony land supports Spanish oaks, Shinnery white oak, Ash, Red bud, and various other small trees and shrubs.

The project area lies at the juncture of three major vegetational areas - Post oak savannah, Blackland prairies, and Cross-timbers. These three areas, while they share many dominant species (such as Big and Little bluestem and a number of Xerophytic oaks), differ markedly in rare and endangered plant species reported.

1.9.2. <u>FAUNA</u> - Sixteen faunal species know to have occured in Texas are Federally listed as endangered. The endangered species and their probability of occurrence in the McGregor area are shown in Table 1-4. The table is based on literature only and does not represent the results of site search. Much of the NWIRP-McGregor site is presently used for grazing cattle.

1.10. <u>MIGRATION POTENTIAL</u>

1.10.1. <u>SURFACE WATER</u> - Contamination of the surface water at the site is possibile. However, this likelihood is minimized by the intermittent nature of the stream flow due to runoff. Most of the surface water percolates into the steam bed or evaporates before it leaves the boundaries of the site. Surface contamination migration, while possible, is probably extremely slow.

1.10.2. <u>SHALLOW GROUNDWATER</u> - The contamination of the upper groundwater, which is in the first few feet of the underlying bedrock is possible due to the vertisol soils of the site. These vertisol soils are subject to developing vertical cracks upon drying. These cracks provide an avenue for contamination migration into the shallow groundwater. The flow of this shallow groundwater would closely approximate that of the surface topography.

1.10.3. <u>HENSEL AQUIFER</u> - Contamination of the Hensel aquifer is extremely unlikely due to its depth beneath the site and the impereability of much of the underlying bedrock. Potential contamination would have to travel vertically some 1000 feet, through impermeable limestone and shale, in order to reach the Hensel aquifer. If contamination did reach the Hensel aquifer, it would take some 9,900-39,600 years to migrate to the nearest point of discharge.

1.10.4. <u>POTENTIAL HUMAN AND ENVIRONMENTAL RECEPTORS</u> - Potential human receptors include base personnel who could come into direct contact with contaminants in the sediments and surface water. Other potential receptors are wildlife, grazing animals, and crops which use the surface waters. Humans are also potential indirect receptors through ingestion of fish, animals and crops.

2.0 <u>FINDINGS</u>

2.1 <u>GENERAL FINDINGS</u>

SOUTHNAVFACENGCOM visited NWIRP McGregor, TX from March 27 to March 30, 1989 to collect information for the Preliminary Assessment (PA) on an outfall

TABLE 1-4

FEDERALLY ENDANGERED AND THREATENED FAUNA - TEXAS

Species[a]	Likelihood of Occurring in Project Area
Texas blind salamander (Typhlomolge rathbuni)	No cave habitat
Fountain darter (Etheostoma fonticola)	No suitable stream habitat
Big Bend Gambusia (Gambusia gaigei)	Not reported in area and no suitable streams
Clear Creek Gambusia (G. heterochir)	Not reported in area and no suitable streams
Pecos Gambusia (G. nobilis)	Not reported in area and no suitable streams
Commanche Springs pupfish (Cyprinodon elegans)	Not reported in area and no suitable streams
Ivory-Billed woodpecker (Campephilus primeipalis)	Restricted
Red-cockaded woodpecker (Dendrocopos borealis)	Not reported in area
Attwater's greater prairie chicken (Tympanuchus cupida)	Possible, but not reported in area
Southern bald eagle (Haliaeetus leucocephalus leucocephalus)	Possible transient
Mexican duck (Anas diazi)	Possible but area is north of usual range
Gray wolf (Canis lupus monstrabilis)	Project area east of reported range
Mexican wolf (C. lupus baileyi)	Project area north of reported range
Red wolf (Canis rufus)	Reports restricted to areas to east
Black-footed ferret (Mustela nigripes)	Unlikely; southernmost extension of range
Houston toad (Bufo houstonensis)	Not reported in area
American alligator (Alligator mississippiensis)	No suitable habitat

NOTES: (a) All species have "endangered status" except American alligator which has "threatened status".

ditch which received effluent contaminated with waste silver from a photographic process in Area 'M'. All data presented here are current as of those dates.

The PA was conducted at NWIRP McGregor Area 'M' outfall ditch in response to the discovery made by Hercules, Inc. that the soils in the ditch (Figure 2-1) exceeds E.P. toxicity levels for silver. The goals of the PA are to identify the source of contamination; the time which contamination occurred; and to determine if a site investigation is required.

2.2. SPECIFIC FINDINGS

Hercules, Inc. analyzed both the sediment and surface water samples for silver. The results of these samples revealed that E.P. toxicity silver is present in the ditch sediments at levels ranging from 0.18 mg/L to 14.7 mg/L and total silver levels range from 0.61 mg/L to 72.1 mg/L. E.P. toxicity chromium was also found in the sediments in levels ranging from 0.06 mg/L to 0.09 mg/L. The surface water silver concentration levels range from 0.02 mg/L to 0.06 mg/L. The effluent from the silver recovery unit has been found to contain silver concentration levels ranging from below 0.05 mg/L to 0.20 mg/L. Table 2-1 and Figure 2-2 provides the location of the samples and their results. See Appendix-A for a copy of the lab results.

2.3. SOURCE OF CONTAMINATION

In 1963 building M-1228 was constructed to house the nondistructive testing equipment used to x-ray motors. This building use to house a 13-MEV LINAC and a GE 1000-KV x-ray machine. These machines have been replaced by a 2-MEV and Varain 200 x-ray machine. These machines are electromagnetic types. A silver recovery unit is operated in the building to reclaim silver from the film developing process developing fluids. The effluent from the reclaimation unit is discharged into an open ditch. This open ditch drains southwards into Station Creek. This discharge is permitted under a NPDES permit.

2.4. TIME OF CREEK CONTAMINATION

In the early 1960's Rocketdyne began operating the nondistructive testing equipment. They began discharging approximately 1500-gallons/day, five days per week, of effluent into the ditch. The review of records have indicate that a silver recovery unit was not used until 1979.

In 1979, a NPDES application to permit miscellaneous discharges stated that this discharge was from a silver recovery unit. The permit further stated that this system consisted of a recirculating silver recovery unit which the fixer solution passed through.

In January 1988, Hercules, Inc. changed out the old silver recovery unit and replaced it with a new recirculating system. This new systems divertes part of the effluent into 55-gallon drums where it is shipped off site for reclaimation or disposal. The remaining effluent is held in a 30 gallon surge tank before being pumped through several 20-gallon steelwool canisters. The steelwool canisters are designed to remove the the excess silver. The

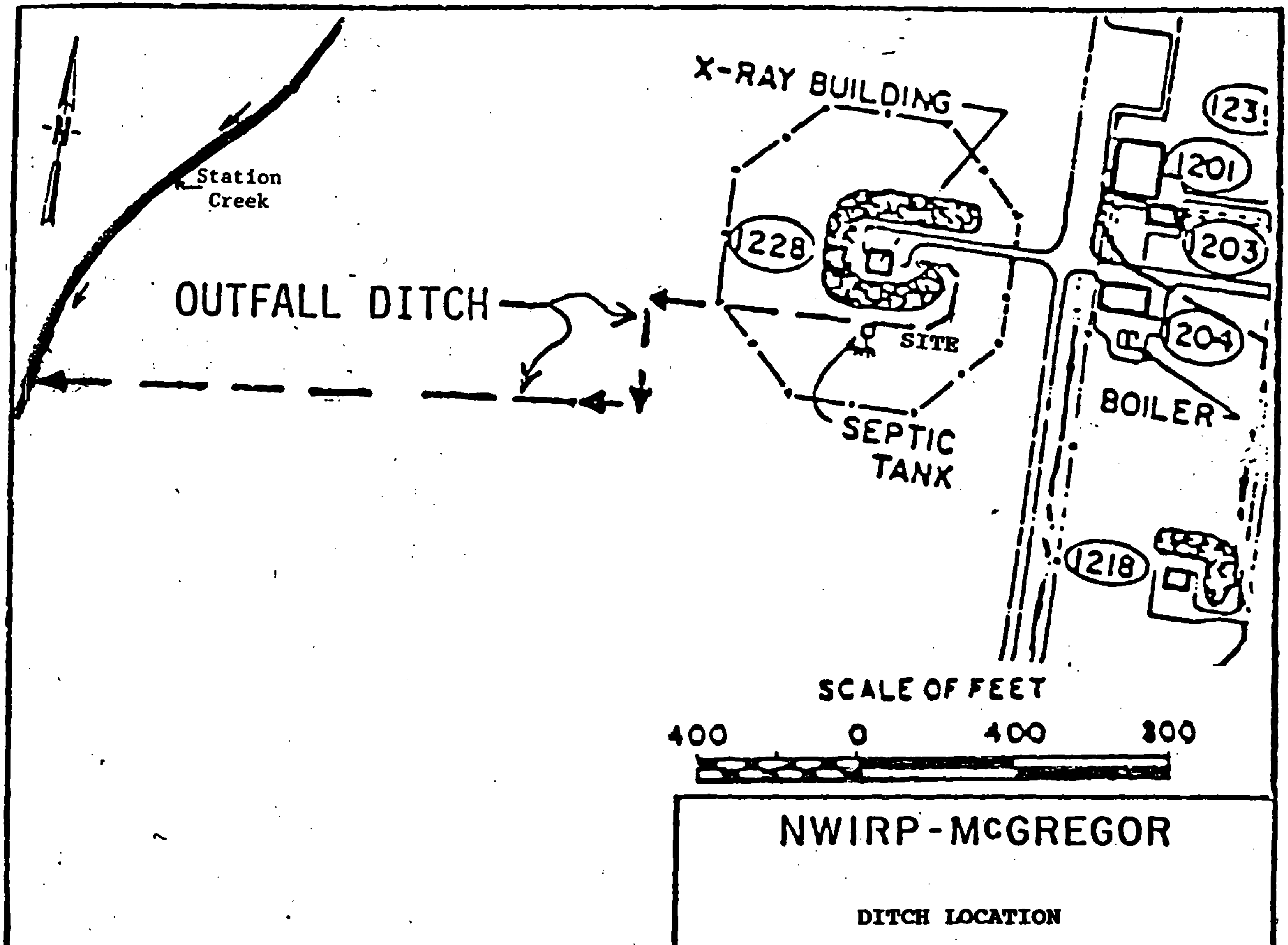
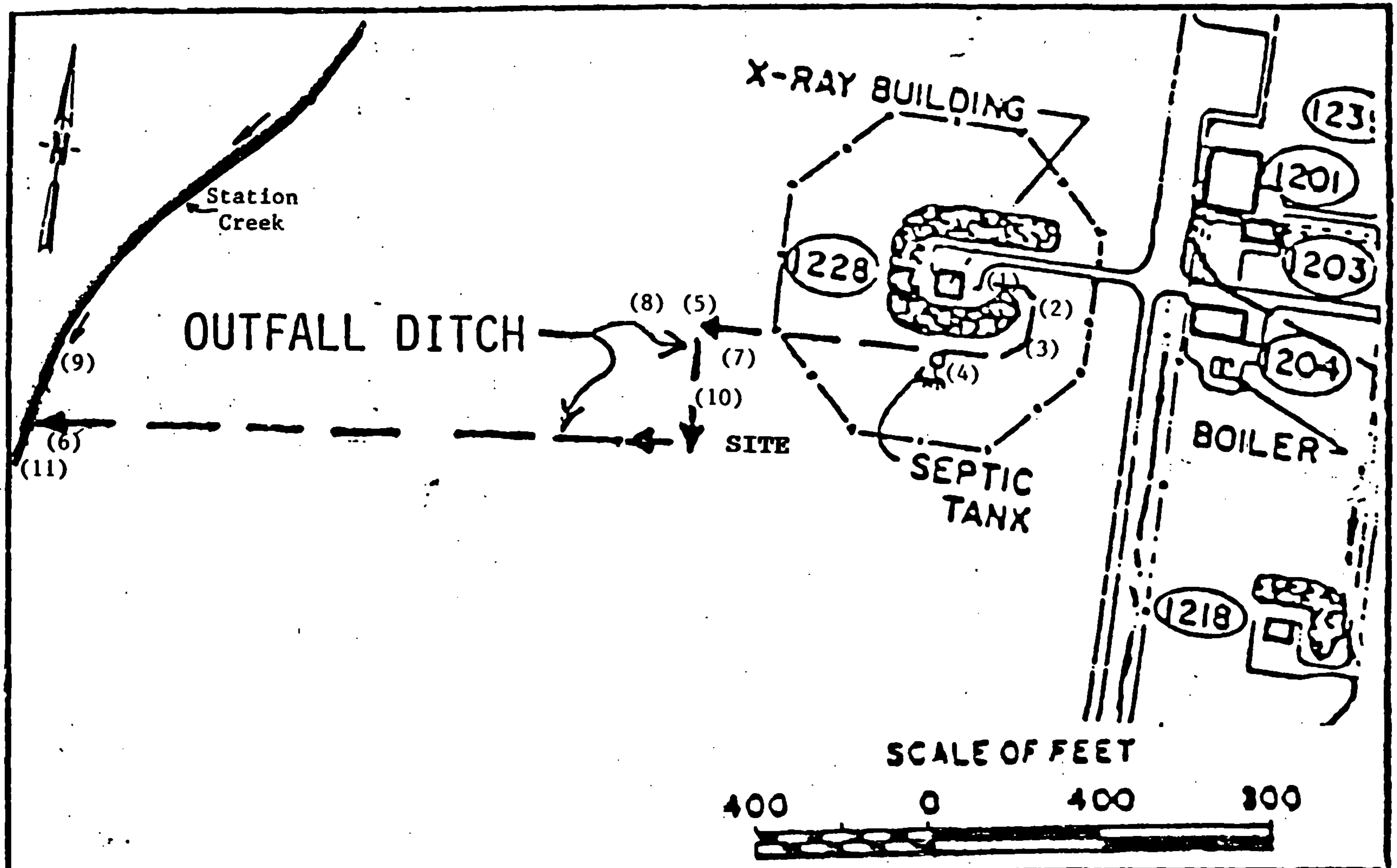

N
Station Creek
OUTFALL DITCH
X-RAY BUILDING
1228
SITE
SEPTIC TANK
1201
1203
1204
BOILER
1218
SCALE OF FEET
400 0 400 800
NWIRP-McGREGOR
DITCH LOCATION

FIGURE 2-1

TABLE 2-1
DITCH SAMPLES
NWIRP MCGREGOR, TX

LOCATION	SAMPLE NO.	AG EP TOX	AG TOTAL	CR EP TOX	HYDROQUINONE	SAMPLE TYPE
(1)	88053-01	2.21 mg/l	15.30 mg/l	0.08 mg/l	NO	Sediment
(2)	88053-02	10.38 mg/l	57.60 mg/l	0.07 mg/l	NO	Sediment
(3)	88053-03	14.70 mg/l	72.10 mg/l	0.09 mg/l	NO	Sediment
(4)	88053-04	11.66 mg/l	61.80 mg/l	0.06 mg/l	NO	Sediment
(5)	88069-01	3.70 mg/kg	12.73 mg/kg			Sediment
(6)	88069-02	2.60 mg/kg	11.05 mg/kg			Sediment
(7)	88069-02	1.90 mg/kg	8.43 mg/kg			Sediment
(8)	88074-01	0.18 mg/kg	0.61 mg/kg			Sediment
(9)	88074-02	0.21 mg/kg	0.77 mg/kg			Sediment
(10)	88038-01	.06 mg/l				Water
(11)	88038-02	0.02 mg/l				Water



NWIRP-McGREGOR

SAMPLE LOCATION

FIGURE 2-2

steelwool canisters are shipped off site for reclaimation or disposal. The effluent, after it passes through these canisters, is discharged into the open ditch.

2.5. ESTIMATION OF EXPOSURE POINT CONCENTRATIONS

The object of this estimation is to evaluate the magnitude and degree of existing or potential risk to public health and the environment. This section has been written using the U.S. Environmental Protection Agency (EPA) Superfund Public Health Evaluation Manual and the U.S. EPA Interim Final RCRA Facilty Investigation (RFI) Guidance Volume I for guidance. The analytical and site-specific data used to assess the exposure at the site has been assembled in this and previous sections of this report.

2.5.1. DESCRIPTION OF ACTIVITY - The description of the activity presents the physical circumstances of the contaminated site and provides relevant information about the site geology, hydrology, topography, drainage, surrounding land use, and a description of the most likely human and environmental receptor populations. Information presented in the Activity Description, Section 1.0, is used to substantiate the exposure scenarios posed in the exposure evaluation and risk characterization of this report.

2.5.2. CONTAMINANT EVALUATION - The contaminant evaluation process identified the types of contamination present. Within this process, a description of the analytical results for silver and chromium was presented from samples obtained from surface water and sediment. This information is described in Section 2.2 of this report.

A toxicity review for silver and chromium was conducted. This section is presented to review the potential health effects as described in Health Advisory documents prepared by the U.S. EPA Office of Drinking Water and Health and Environmental Effect Profiles (40 CFR 261) by the U.S. EPA. A brief toxicological profile of silver follows: Silver is a white ductile naturally occuring element in the earth's crust and occurs in pure form or in ores. Silver and its compounds are used in photographic materials, electroplating, dental alloys, solder and brazing alloys, paints, jewelry, silverware, coinage and mirror production.

Silver can exist in two valence states, Ag+ and Ag++. The solubility of common silver salts varies greatly. The National Association of Photographic Manufactures, Inc. report titled Environmental Effects of Photoprocessing Chemicals Volume I, has reported that no free silver ions are discharged from photographic processes, but rather as silver thiosulfate complexes. It is also reported that sulfide, resulting from the breakdown of thiosulfate or other components in a sewage system, will precipitate the silver as silver sulfide. Silver sulfide is highly insoluable.

In general, silver in zero valence state is not considered to be toxic, but most of its salts are toxic to a large number of organisms. Silver salts, if ingested, are absorbed in the human circulatory system and deposited in various body tissues. This results in generalized or localized gray pigmentation of the skin and mucous membranes. 1mg/m3 of Ag dust causeses the same type of generalized and localized skin effects.

Silver has not been shown to cause cancer. Silver has also been found not to be mutagenic or teratogenic.

The U.S. EPA Office of Solid Wastes have derived an RfD of 0.003 mg/kg/day for silver. The U.S. EPA has a Maximum Contaminant Level (MCL) of 50 ug/L for silver in drinking water. The RfD will be used to calculate the hazard index associated with human exposure to this compound and calcualtions of dose and corresponding health risk will be based on noncarcinogenic effects.

A brief toxicological profile of chromium follows: Chromium is a relatively rare, naturally occurring element in the earth's crust and occurs in most rocks and minerals at concentrations of 200 ppm. Chromium is not mined in the United States commercially and is imported. Chromium and its compounds are used in alloys, pigments, photographic process, and the manufacturing of leather and textiles, catalysts, and wood preservatives.

Chromium can exist in several oxidation states from -2 to +6. In the natural oxygentated environment, chromium exists in three principle states: element (Cr0), trivalent (Cr+3), and hexavalent (Cr+6).

In general, Cr+6 compounds are more toxic than Cr+3 compounds because Cr+6 can transverse biological membrans by diffusion or facilitated transport. The toxicity of chromium has been attributed primarily to Cr+6, which has been shown to produce liver and kidney damage, internal hemorrage, dermatitis, and respiratory problems. The immediate symptoms of exposure are generally nausea, repeated vomiting, and diarrhes. Dermal exposure to chromic acid may cause dermatitis and ulceration of the skin. Chronic inhalation of dust or air containing Cr+6 may cause repiratory problems including ulcerated nasal septa and decreased respiratory volumes. There is inadaquate evidence to determine whether or not oral exposure to chromiun can lead to cancer. However the carcinogencity of inhaled Cr+6 is well established for humans in an occupational setting. Cr+6 has also been found to be both mutagenic and teratogenic.

In photographic process, hexavalent chromium is present in acid dichromate bleaches. When these bleaches are mixed in the effluent with solutions containing reducing agents such as thiosulfate, the chromium may be reduced to the trivalent form.

The U.S. EPA Office of Solid Wastes has derived an RfD of 1.0 milligrams per kilogram per day (mg/kg/day) for Cr+3 and 0.005 mg/kg/day for Cr+6. The U.S. EPA has a MCL of 50 ug/L for total chromium in drinking water and proposed a Maximum Contaminant Level Goal (MCLG) of 120 ug/L. The EPA has classified the potential carcinogenicity of chromium as Class D: Not Classified. This category is for chemical agents with inadequate animal evidence of carcinogenicity. The analysis for the surface water samples obtained at the site were not analyzed for hexavalent chromium. However, due to the low levels of chromium detected and the present of thiosulfate in the effluent, it will be assumed that hexavalent chromium will not be present. Thus, the RfD for trivalent chromium will be used to calculate the hazard index associtated with human exposure to this compound, and calculations of dose and corresponding health risk will be based on noncarcinogenic effects.

2.5.3. <u>DOSE-RESPONSE EVALUATION</u> - The toxicological features of the chemicals identified will be the dose/response assessment addressed in this section. The discussion of adverse effects for the indicator chemicals is usually divided into carcinogenic and noncarcinogenic effects. However, since hexavalent chromium is assumed not to be present carcinogenic effects will not be evaluated. This section will be restricted to the evaluation of the noncaracinogenic effects of silver and chromium.

Noncarcinogenic responses are generally believed to have a threshold value, which is a finite dose at which adverse responses are not elicited. A single compound might elicit several adverse effects depending on the dose and the length and route of exposure. In developing standards of criteria for a compound, the critical toxicity value, RfD or dose which elicits the most sensitive response in the most sensitive test organism, is used to establish the RfDs. In assessing risks, the most sensitive response is used to determine whether exposure is acceptable.

Comparison between the maximum silver concentration reported in the surface water at the site and the current federal guidlines (Table 2-2) provides an initial method of distinguishing potential risks, with regard to the criteria to protect aquatic life. The reported concentrations of silver are several orders of magnitude greater than the environmental criteria presented in Table 2-2.

2.5.4. <u>EXPOSURE EVALUATION</u> - The purpose of the exposure assessment is to identify the routes of exposure (inhalation, dermal contact, and ingestion) by which contaminants are transported from the site, and the contaminant dosage to human receptors.

The contamination release source is from a silver recovery system discharge. This discharge is estimated to contain residual silver in concentration between below 0.05 mg/L to 0.2 mg/L and an undetermined amount of chromium. There are two release mechanismes associated with this type of release source, volatilization and episodic overland flow. Contaminates, if volatilized, my be released into the air were it can be inhaled and/or dermal contact. Episodic overland flow releases contaminates into the surface water and sediments. The exposure to the surface water can be by ingested and/or dermal contact. The exposure to the sediments of can be by inhalation and/or ingestion and/or dermal contact.

A summary of the potential human exposure routes (Table 2-3) shows that eight potential contaminant exposure routes are completed at the site. These are: dermal contact with the surface water, dermal contact with the sediment, ingestion of the surface water and uptake by plants and animanls, the ingestion of the sediments and uptake by the plants and animals, and the inhalation of volatilized contaminants and inhalation of fugitive dusts. For convenience, the eight exposure pathways have been combined into five pathways to more correctly quantify the contaminant dose following exposure. These are: dermal contact of the sediment, ingestion of sediment, dermal contact of the surface water, ingestion of surface water and the inhalation of fugitive dust. The food ingestion of both the sediment and the surface water and volatile inhalation was not calculated because samples were not collected and the exposure scenarios for these pathways are not like to be worst than the scenario for surface water (dermal contact/ingestion). The dermal

TABLE 2-2. APPLICABLE OR RELEVANT, AND APPROPRIATE REQUIREMENTS (ARARS)

Indicator Chemical	State of 1/ Texas Water Quality Standards (mg/L)	EPA 2/ MCL (mg/L)	EPA 3/ Proposed MCLG (mg/L)	ACGIH 4/ TLV (mg/m3)	Federal Water Quality Criteria 5/ Fish Consumption Only (mg/L)	Water and Aquatic Life (mg/L)	Aquatic Life Acute Tox (mg/L)	Aquatic Life Chronic Tox (mg/L)	Maximum Reported Concentration in Surface Water (mg/L)
Silver (effluent)	0.05	0.05	---	1.0	---	0.00005	0.004	0.0001	0.2
Chromium	0.05	0.05	0.12	0.5	3433	170	1.70	0.2	unknown

1/ State of Texas Water Quality Standards
2/ Federal Register
3/ Federal Register
4/ American Conference of Government Industrial Hygienists. 1987-1988
5/ USEPA, Office of Water, Regulations and Standards, Quality Criteria for Water 1986
--- Not available

TABLE 2-3 PRESENT POTENTIAL HUMAN EXPOSURE ROUTES FROM THE SITE

ROUTE EXPOSURE	PHYSICAL AND CHEMICAL FEATURES	ENVIRONMENTAL	RECEPTOR	CURRENT PROBABILITY OF EXPOSURE	FUTURE PROBABILITY OF EXPOSURE WITHOUT REMEDIAL ACTION	PRIMARY COMPLETE
Dermal Contact with soil in the ditch	Silver is weakly absorbed to soil particles. Silver can be absorbed by skin.	The ditch is open but is restricted to the public.	The workers at Building 1220 and grounds keeper.	low	low	yes
Dermal Contact with surface water in ditch	Silver is soluble in water unless it is a silver sulfide. Silver can be absorbed by skin.	The ditch is open but is restricted to the public.	The workers at Building 1220 and grounds keeper.	low	low	yes
Ingestion of soil in the ditch	Silver is weakly absorbed to soil particles. Silver is easily absorbed by ingestion.	The ditch is open but is restricted to the public.	The workers at Building 1220 and grounds keeper.	low	low	yes
Ingestion of surface water in ditch	Silver is soluble in water unless it is a silver sulfide. Silver is easily absorbed by ingestion.	The ditch is open but is restricted to the public. No potable wells are are used near the site.	The workers at Building 1220 and grounds keeper.	low	low	yes
Ingestion of soil in the ditch through food	Silver is weakly absorbed to soil particles. Silver is easily absorbed by animals and can be passed to humans.	The ditch is open but is restricted by a fence from farm animals and no crops are grown in the area.	The individuals which may eat either the animals or grasses.	very low	very low	yes
Ingestion of surface water in the ditch through food	Silver is soluble in water unless it is a silver sulfide. Silver is easily absorbed by animals and crops.	The ditch is open but is restricted by a fence from farm animals and no crops are grown in the area.	The individuals which may eat either the animals or grasses.	very low	very low	yes
Inhalation of volatilized contaminant	Silver is not volatile by it but in solution may be.	The ditch is open but is restricted from the public.	The workers at Building 1220 and grounds keeper may be exposed but the silver concentrations interia Building 1220 do not exceed acceptable levels.	very low	very low	yes
Inhalation of fugitive dust	Silver is weakly adsorbed to soil particles.	The ditch is covered with vegetation.	The workers at Building 1220 and grounds keeper.	very low	very low	yes

contact/ingestion of the surface water for chromium was not calculated because there are no analytical results indicating the concentration of chromium in the surface water. The chromium concentrations used in the calculations is eighty percent greater than the reported EP Toxicity concentration in order to relate the chromium values near expected total chromium concentration.

Dermal contact of sediments at the site was described as an exposure event of low probabilities of occurrence. The site is restricted to the public. The only humans might come into direct contact with the sediments would be the grounds keeper and/or a farmer, and/or one of the workers at building M 1228. The exposure scenario which is used is one which quantifies the noncarcinogenic risk posed by these individuals if they cover their face, neck, hands and feet with the sediment. The constituent/concentrations is the maximum reported concentration of the silver and eighty percent greater than the maximun reported concentration of the chromium. The skin surface area is assumed to be 3390.0 sq cm and the body weigth is assumed to be 70 kg. The soil adherence factor is assumed to be that of commercial potting soil which is 1.45 mg/cm2. The absorption factor is assumed to be the highest, which is 1. This exposure scenario is hypothetical and does not reflect actual conditions observed at the site. The exposure scenario is considered a liberal exposure estimate. The Chronic Daily Intake (CDI) is calculated by: Sediment concentration (mg/kg) x (skin surface area (sq cm)/ body weight (kg)) x Soil adherence factor (mg/sq cm/day) x Absorption factor) x Unit conversion factor (kg/mg) which equals mg/kg/day. The daily exposure summary for silver at a concentration of 72.1 mg/kg is calculated to be .0051 mg/kg/day. The CDI is greater than the RfD (0.003 mg/kg/day) for dermal contact for silver. The CDI for chromium at a concentration of 0.44 mg/kg is calculated to be 0.000044 mg/kg/day which is less than its RfD of 1.0 mg/kg/day.

Ingestion of sediments at the site was described as an exposure event of low probabilities of occurrence. The site is restricted to the public. The only humans might come into direct contact with the sediments would be the grounds keeper and/or a farmer, and/or one of the workers at building M 1228. The exposure scenario which is used is one which quantifies the noncarcinogenic risk posed by these individuals if they ingest 10 mg of sediment each day. The constituent/concentrations is the maximum reported concentration of the silver and eighty percent greater than the maximun reported concentration of the chromium. The body weigth is assumed to be 70 kg. This exposure scenario is hypothetical and does not reflect actual conditions observed at the site. The exposure scenario is considered a liberal exposure estimate. The Chronic Daily Intake (CDI) is calculated by: Sediment concentration (mg/kg) x (Sediment consumption (mg/day)/ body weight (kg)) x Unit conversion factor (kg/mg) which equals mg/kg/day. The daily exposure summary for silver at a concentration of 72.1 mg/kg is calculated to be .0000103 mg/kg/day. The CDI is less than the RfD (0.003 mg/kg/day) for ingested silver. The CDI for chromium at a concentration of 0.44 mg/kg is calculated to be 0.000000063 mg/kg/day which is less than its RfD of 1.0 mg/kg/day.

Dermal contact of surface waters (effluent) at the site was described as an exposure event of low probabilities of occurrence. The site is restricted to the public. The only humans might come into direct contact with the surface water would be the grounds keeper and/or a farmer, and/or one of the workers at building M 1228. The exposure scenario which is used is one which quantifies the noncarcinogenic risk posed by these individuals if they submerge their bodies in the surface water each day for eight hours. The constituent/concentrations is the maximum reported concentration of the silver in the effluent. The skin surface area is assumed to be 19000.0 sq cm and the body weigth is assumed to be 70 kg. The water flux throught the skin is taken to be 0.5 mg/cm2-hour. The absorption factor is assumed to be the highest, which is 1. This exposure scenario is hypothetical and does not reflect actual conditions observed at the site. The exposure scenario is considered a liberal exposure estimate. The Chronic Daily Intake (CDI) is calculated by: Surface water concentration (mg/L) x (skin surface area (sq cm)/ body weight (kg)) x Water flux factor (mg/sq cm/day) x Absorption factor x Exposure duration (hrs/day)) x Unit conversion factor (kg/mg) which equals mg/kg/day. The daily exposure summary for silver at a concentration of 0.2 mg/L is calculated to be 0.0002 mg/kg/day. The CDI is less than the RfD (0.003 mg/kg/day) for dermal contact for silver.

Ingestion of surface waters (effluent) at the site was described as an exposure event of low probabilities of occurrence. The site is restricted to the public. The only humans might come into direct contact with the surface water would be the grounds keeper and/or a farmer, and/or one of the workers at building M 1228. The exposure scenario which is used is one which quantifies the noncarcinogenic risk posed by these individuals if they ingest two liters of surface water each day. The constituent/concentrations is the maximum reported concentration of the silver in the effluent. The body weigth is assumed to be 70 kg. This exposure scenario is hypothetical and does not reflect actual conditions observed at the site. The exposure scenario is considered a liberal exposure estimate. The Chronic Daily Intake (CDI) is calculated by: Surface water concentration (mg/L) x (Water consumption (L/day)/ body weight (kg)) which equals mg/kg/day. The daily exposure summary for silver at a concentration of 0.2 mg/L is calculated to be 0.0057 mg/kg/day. The CDI is greater than the RfD (0.003 mg/kg/day) for dermal contact for silver.

Inhalation of fugitive dust at the site was described as an exposure event of low probabilities of occurrence. The site is restricted to the public. The only humans might come into direct contact with fugitive dust would be the grounds keeper and/or a farmer, and/or one of the workers at building M 1228. The exposure scenario which is used is one which quantifies the noncarcinogenic risk posed by these individuals if they inhale 20 m3 of dust each day. It will be assumed that they will be exposed for 24 hours a day. The constituent/concentrations is the maximum reported concentration of the silver and chromium in the sediment times the maximum amount of dust which can be suspended in air (10 mg/m3). The body weigth is assumed to be 70 kg. The absorption factor is assumed to be the highest, which is 1. This exposure scenario is hypothetical and does not reflect actual conditions observed at the site. The exposure scenario is considered a liberal exposure estimate. The Chronic Daily Intake (CDI) is calculated by: Air concentration (mg/m3) x (Inhalation rate (m3/hr)/ body weight (kg) x Exposure duration (hrs/day) x Absorption factor) equals mg/kg/day. The daily exposure summary for silver at a concentration of 72.1 mg/kg is calculated to be 0.0007 mg/kg/day. The CDI is less than the RfD (0.003 mg/kg/day) for dermal contact for silver. The daily exposure summary for chromium at a concentration of 0.44 mg/kg is calcualted to be 0.0000042 mg/kg/day whic is less than the RfD of 1.0 mg/kg/day.

2.5.5. <u>RISK CHARACTERIZATION</u> - Risk characterizations are developed to evaluate the impact to public health. The environmental risk assessment qualitatively assesses the potential risk based on published aquatic tocicity data for silver and chromium. The risk characterization for potential impacts to public health has been developed from analytical data and toxicological profiles.

This quantitative risk assessment involves the calculation of health risk levels that represents the possibility of exceeding the RfD (noncarcinogens) under the conditons described in the exposure scenario. Calculations of risk are made to overestimate the actual risks so as to evaluate the "worst case" scenarios for the purpose of determining the regulatory impact.

The health risk estimate for exposure to a noncarcinogen (Hazard Index) is determined by dividing the Chronic Daily Intake (CDI) or estimated dose by the Risk Reference Dose (RfD). The RfD is an estimate of the daily exposure to the human population that is likely to be without appreciable risk of deleterious effects over a lifetime, and is derived from the No-Observed-Adverse-Effect-Level (NOAEL), identified from a chronic (or subchronic) study, divided by an uncertainty factor(s). This method of health risk estimate allows for the evaluation of a single chemical or multiple subthreshold chemical exposures. When the hazard index of any chemical (or many chemicals that induce the same effect on the same mechanism) poses an exposure dose level greater than the reference dose level (hazard index ratio greater than one), there may be concern for a potential health risk.

Human health risk posed by dermal contact of the sediments for the individuals on site is greater than the RfD for silver and several orders of magnitude less than the RfD for chromium. The hazard index for an adult exposed to the contaminated sediments is 1. Thus there exist a real concern for a potential health risk for this contamination. To minimize this potential health risk, the removal of the sediments will be necessary.

Human health risk posed by ingestion of the sediments for the individuals on site is a couple of orders of magnitude less than the RfD for silver and several orders of magnitude less than the RfD for chromium. The hazard index for an adult is 0.034 for silver and 6.3 x10-8 for chromium for the maximum reported concentrations.

Human health risk posed by dermal contact of the surface water for the individuals on site is in the same magnatiude but less than the RfD for silver. The hazard index for an adult is 0.067 for silver.

Human health risk posed by ingestion of the surface water for the individuals on site is in the same magnatiude but greater than the RfD for silver. The hazard index for an adult is 1 for silver. To minimize this potential health risk, the removal of the release source will be necessary.

Human health risk posed by inhalation of fugitive dust for the individuals on site is a magnatiude less than the RfD for silver and several orders of magnitude less than the RfD for chromium. The hazard index for an adult 0.23 for silver and 8.6x10-7 for chromium.

A risk characterization of the current human contaminant exposure routes at the site has shown that the dermal contact with the sediment and ingestion of the effluent routes of exposure poses health risks in excess of the RfDs for silver. In addition, the health risks posed by the sum of all five exposure scenarios exceed the RfD for silver. If the release source and sediment is removed then there would not exist a human health risk.

Environmental health risks may be occurring due to the presence of silver contamination. The maximum reported concentration for silver is greater than the fresh water aquatic live acute toxicity and chronic toxicity levels for silver. Adverse environmental effects beyond the site and property boundary may occur based on comparisons to environmental standards and information describing the extent of contamination.

3.0. RECOMMENDATIONS

A Site Inspection (SI) is recommended for this site to gather additional information on the extent of contamination in the ditch and surface water and to determine if the waste silver has left the property. Prior to conducting a site inspection, a removal action is recommended to be conducted to remove the release source (effluent) as well as to remove the sediment which exceeds E.P. toxicity for silver. This will protect the aquatic life, grazing animals and humans from further exposure.

The SI should be conducted only after the removals actions are completed. The SI should consist of sediment samples taken from the ditch, from the outfall to the property line. Surface water samples should also be taken. If there is no surface water present then pizometers should be installed and the shallow ground water sampled. The samples should be analyzed for total and E.P. toxicity silver and chromium. The objective of the sampling will be to determine the effectiveness of the removal action and to determine the horizontal and vertical extent of any residual contamination.

REFERENCES

Naval Energy and Environmental Support Activity, Port Hueneme, CA, March 1983 "Initial Assessment study of Naval Weapons Industrial Reserve Plant, McGregor, Texas" NEESA 13-006.

Southern Division Naval Facilities Engineering Command, Charleston, SC August 1983 "NACIP Confirmation study and Summary of Remedial Action Naval Weapons Industrial Reserve Plant, McGregor, Texas.

Hercules Incorporated, 8 August 1988 from Hercules to SOUTHNAVFACENGCOM, notification of potential silver contamination and to request assistance.

Naval Energy and Environmental Support Activity March 1988 from Jeff to Robert Moser forwarding NEESA files on the silver recovery unit in area M.

U.S. Environmental Protection Agency, Waste Management Division Office of Solid Waste, "Interim Final RCRA Facility Investigation (RFI) Guidance", Volume 1, EPA 530/SW-89-031, May 1989.

APPENDIX 1
LAB RESULTS

CENTRAL TEXAS QUALITY ASSURANCE LABORATORY
P.O. Box 23147
WACO, TEXAS 76702-3147

GERARD N. SCHANK

OFFICE (817) 772-5549
HOME (817) 772-3899

July 14, 1988

Ms. Margaret Bourne
Hercules, Inc.
P.O. Box 548
McGregor, Tx. 76657

Dear Ms. Bourne,

The four samples dated 6/2/88 were analyzed as per your request with results as follows:

	E.P. Toxic Ag	Total Ag	E.P. Toxic Cr	Hydroquinone
88053-01	2.21 mg/l	15.30 mg/l	0.08 mg/l	Not Detected (<5 mg/kg)
88053-02	10.38 mg/l	57.60 mg/l	0.07 mg/l	Not Detected (<5 mg/kg)
88053-03	14.70 mg/l	72.10 mg/l	0.09 mg/l	Not Detected (<5 mg/kg)
88053-04	11.66 mg/l	61.80 mg/l	0.06 mg/l	Not Detected (<5 mg/kg)

Sincerely,

Gerard N. Schank

Gerard N. Schank

CENTRAL TEXAS QUALITY ASSURANCE LABORATORY
P.O. Box 23147
WACO, TEXAS 76702-3147

GERARD N. SCHANK

OFFICE (817) 772-8549
HOME (817) 772-3899

July 22, 1988

Ms. Margaret Bourne
Hercules, Inc.
P.O. Box 548
McGregor, Tx. 76657

Dear Ms. Bourne,

The three samples received 7-15-88 were analyzed with results as follows:

	E.P. Toxic Ag	Total Ag
88069-01	3.70 mg/kg	12.73 mg/kg
88069-02	2.60 mg/kg	11.05 mg/kg
88069-03	1.90 mg/kg	8.43 mg/kg

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HEALTH AND SAFETY PROGRAM

INITIAL SITE REMEDIAL ACTIONS
AT
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT (NWIRP)
McGregor, Texas
For
CIBA-GEIGY CORPORATION

MCGREGOR NAVAL WEAPONS
TX9170024208
X-Ref 8A Vol 1

July 2, 1984

By
ERM-Southwest, Inc.
8989 Westheimer, Suite 111
Houston, Texas 77063
(713) 789-6652

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REORGANIZED

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1 - INTRODUCTION

The Health and Safety Program presented herein was prepared by ERM-Southwest, Inc. The program will be implemented and followed by Southwest Closures, Inc. (SWCI) and its subcontractor Sprint Waste Disposal Company (SWDC) during the planned removal remedial actions at the Naval Weapons Industrial Reserve Plant (NWIRP) site in order to protect the health and safety of the work force. SWCI's policy is to conduct all activities in the manner required to protect the health and safety of the project personnel and the public. All work will be in accordance with applicable federal, state, and local regulations, including the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), and requirements of 29 CFR 1910. This program is designed for use during all remedial actions at the site.

The SWCI field manager will be responsible for continuous adherence to the safety procedures during the conduct of the work. In no case may work be performed in a manner that conflicts with the intent of or the safety and environmental concerns expressed in this program. Personnel violating safety procedures will be removed from the job.

It is the objective of this Health and Safety Program to provide safe working conditions for personnel at the site. The safety organization and procedures have been established based on an analysis of potential hazards, and personnel protection measures have been selected to respond to these risks. The Safety Program defines procedures to be used while at the site and the personnel protective equipment required.

1.1 Safety Organization

The Health and Safety Program for the approved remedial actions at the NWIRP site were developed for all subcontractors, project team members and any Navy or Hercules personnel present as observers on-site during the removal operations. The on-site Health and Safety officer will be Mr. Harry Little, P.E. of ERM-Southwest, who will supervise all site operations including excavation, health and safety operations and training, and decontamination of workers and equipment. Should Mr. Little leave the site during operation, this function will be served by Mr. Guy Swinford of ERM-Southwest, who will also be on-site during all removal actions.

Prior to initiation of removal operations, Mr. Little and Mr. Swinford will stake and flag the areas to be scraped and will delineate exclusion, decontamination and support ("clean") areas. Mr. Little will be responsible for on-site training, orientation and personnel safety. He will also supervise the proper day-to-day execution of the personnel protection program and prohibit improperly prepared personnel from entering or working in the site areas to be designated as "hot" zones (areas which require use of protective equipment and clothing).

1.2 Site Conditions

The NWIRP is a government owned facility operated by Hercules Inc. The plant was originally acquired by the U.S. Army Ordinance Corps in 1942. In the past, waste pesticides were apparently dumped on the surface of the ground in the western portion of Area G. The dumping area covers portions of an area roughly 800' long by 100' wide and is located in a remote area of the plant. Because of current concerns of the health effects of the chlorinated pesticides involved, the U.S. Department of Justice at the request of the Navy Department has filed suit against Ciba-Geigy Corporation asking that Ciba-Geigy secure the site.

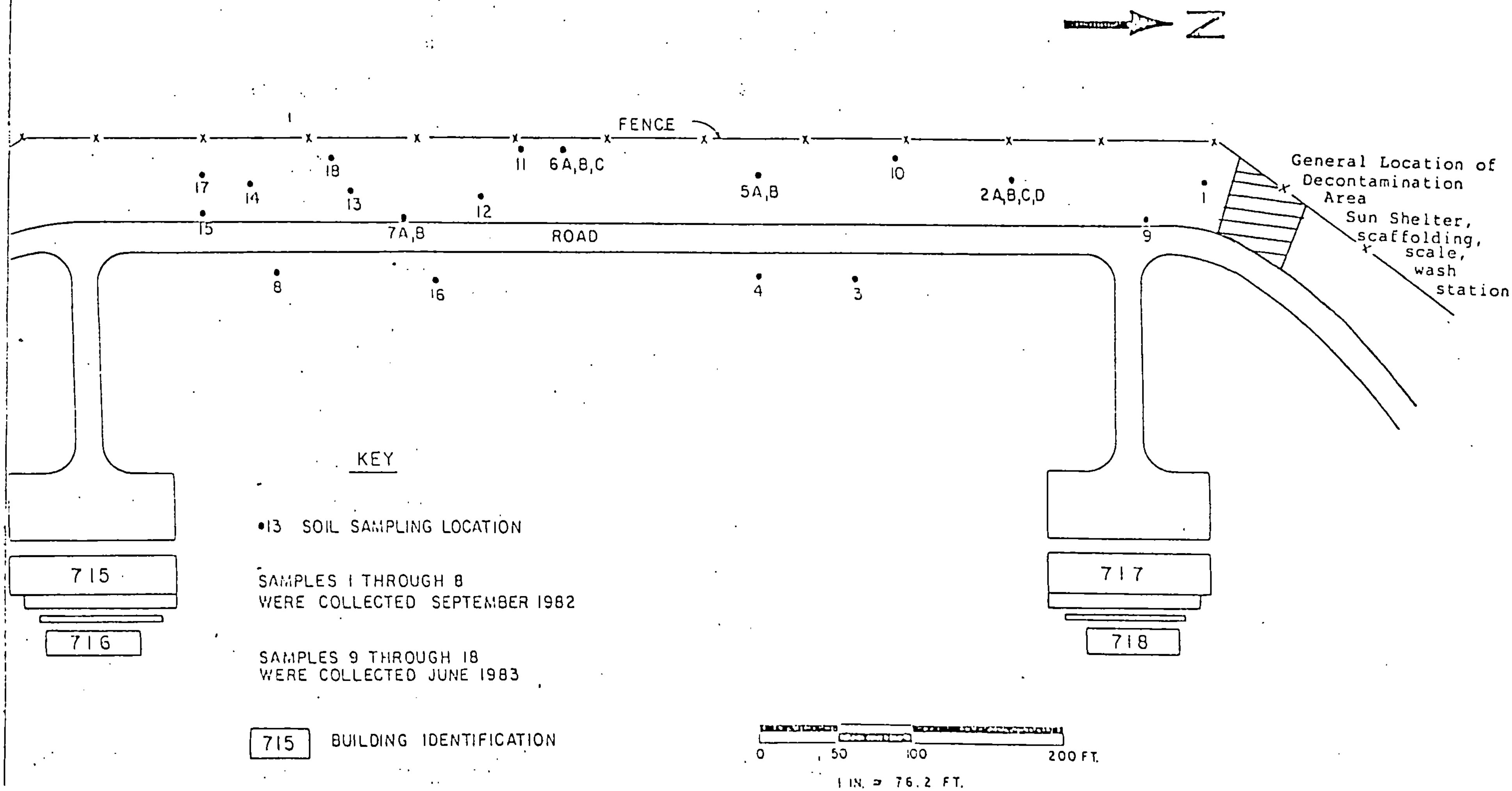
The contaminated surface soil is native soil with pesticides spilled on the surface. These pesticides include DDT, toxaphene, aldrin-dieldrin, chlordane-heptachlor, BHC-lindane, and endrin. Concentrations of pesticides in the surface soil range from very low concentrations to almost 100% pure pesticides.

The disposal area is a rectangle approximately 743 feet long by 50 feet wide running parallel to a gravel road (Figure 1). The 47 individual spill areas that have been identified visually range in size from 3 feet by 6 feet to 180 feet by 15 feet. The individual spill areas were characterized as bare spots in the otherwise thick grass cover. Depth of contamination is believed to be 4 inches or less.

Debris scattered around the spill areas include broken laboratory type glassware, a few rusted away barrels and pesticide bags.

Remediation efforts proposed by SWCI include the careful excavation of each of the 47 individual spill areas to an average depth of 4 inches. The resulting excavated volume was estimated to be 122 cubic yards. A small crawler type

FIGURE 1
SOIL SAMPLING LOCATIONS
AREA G – PESTICIDE DUMP



backhoe will be utilized that provides the operator with a full view of bucket operations. The backhoe excavation will be augmented by manual labor performed by a hazardous waste specialist.

The excavation will proceed along the long axis of the disposal area, starting at the south end of the contaminated area and progressing northward towards the decontamination area (Figure 1). This strategy will minimize any recontamination of previously scraped areas due to vehicular activity and backhoe operations.

1.3 Hazard Analysis

The following hazard analysis was conducted to ensure that site activities, personnel protection, and emergency response are consistent with the specific contaminants expected to be encountered. The hazard analysis forms the foundation for this Health and Safety Program.

The contaminants of concern at the site are DDT, chlordane-heptachlor, toxaphene (chlorinated camphene), aldrin-dieldrin, BHC-lindane, and endrin (Table 1). These are all chlorinated carbon ring compounds used as pesticides and are all toxic to varying degrees. They are readily absorbed into the skin and are fatal if aspirated or ingested in sufficient quantity. The primary target organ is the CNS (Central Nervous System) for acute exposure. Chronic exposure of most of these pesticides have been shown to result in liver damage in laboratory animals.

A brief description of the physical characteristics of each of these pesticides follows:

1. ALDRIN* - ($C_{12}H_8Cl_6$) a triple-ring compound of two unsaturated benzene rings, and one pentyl ring to which six chlorides are attached. Aldrin is a tan to dark brown solid with a mild chemical odor. Considered moderately toxic.

2. CHLORDANE - $C_{10}H_6Cl_8$ approximately). A triple-ring compound composed of one unsaturated benzene ring with four chloride radicals and two pentyl groups, one of which carries a chlorinated methyl group and the other of which has two chloride radicals. A thick amber liquid with a chlorine-like odor. Considered moderately toxic.

TABLE 1

Chemical Name and Formula	Permissible Exposure Limit (TLV-TWA)*	STEL*	IDLH Level	Chemical & Physical Properties		Incompatibilities
Aldrin	0.25 mg/m^3 (Skin)	0.75 mg/m^3	100 mg/m^3	MW: 365 BP: Decomposes Sol: Insoluble Not combustible, flamm solv	VP: 0.000006 mm MP:220F	None Hazardous
Chlordane	0.5 mg/m^3 (Skin)	2.0 mg/m^3	500 mg/m^3	MW: 410 BP: Decomposes Sol: Insoluble Not combustible	VP: 0.00001 mm MP:?	Strong oxidizers
Chlorinated Camphene (Toxaphene)	0.5 mg/m^3 (Skin)	1.0 mg/m^3	200 mg/m^3	MW:414 BP: Decomposes Sol: 0.0003% Fl.P: 275 F	VP:0.2 to 0.4 mm MP: 158 to 203 F UEL:? LEL:?	Strong oxidizers
DDT	1 mg/m^3 (air)	3.0 mg/m^3	N.A.	MW: 355 BP: Decomposes Sol: 0.00001 Not combustible	V.P.: 1.7 x 10 mm MP: 228F	Strong oxidizers
Dieldrin	0.25 mg/m^3 (Skin)	0.75 mg/m^3	450 mg/m^3	MW: 381 BP: Decomposes Sol: 110 ppb Not combustible	VP: 1.8 x 10 mm MP: 349F	Strong oxidizers active metals like sodium, strong acids, phenols

TABLE 1 (Continued)

Chemical Name and Formula	Permissible Exposure Limit (TLV-TWA)*	STEL*	IDLH Level	Chemical & Physical Properties		Incompatibilities
Endrin	0.1 mg/m^3 (Skin)	0.3 mg/m^3	200 mg/m^3	MW: 381 BP: Decom-poses Sol: 160 ppb Not combustible, but may be dissolved in flammable solvent	VP: 2 x 10 mm MP: Decom-poses	Strong oxidizers, strong acids
Heptachlor	0.5 mg/m^3 (Skin)	2.0 mg/m^2	100 mg/m^3	MW: 374 BP: Decom-poses Sol: Insoluble Not combustible	VP: 0.0003 mm MP: 114 to 165 F May be dissolved in flammable liquid	Melted heptachlor with iron and rust
Lindane	0.5 mg/m^3 (Skin)	1.5 mg/m^2	1000 mg/m^3	MW: 291 BP: Decom-poses Sol: 0.001% Not combustible	VP: 9.4 x 10 mm MP: 234 F May be dissolved in combustible solvent	None Hazardous

* TLV-TWA = Threshold Limit Value - time weighted average = 8 hour work day/40 hour work week acceptable exposure limit, no adverse effect
* STEL = Short-term exposure limit = 15 minute time-weighted average exposure limit, no more than 4 times per day and no more frequent than 60 minute intervals
* IDLH = Immediately Dangerous to Life or Health = maximum level from which one could escape within 30 minutes w/out any escape - impairing symptoms or any irreversible health efforts

SOURCE: ACGIA, 1983-84
OSHA, 1978

3. Chlorinated camphene (TOXAPHENE) - ($C_{10}H_{10}Cl_8$ approximately) A mixture containing polychlorinated cyclic terpenes with chlorinated camphene predominating; empirical formula is not precisely known. A waxy, amber-colored solid with a mild turpentine-like odor. Considered moderately toxic.

4. DIELDRIN* - ($C_{12}H_8Cl_6O$) A quadruple-ring compound composed of one unsaturated benzene ring and three pentyl rings, one of which carries the six chloride radicals and one of which carries the oxygen radical. Dieldrin is a colorless to light tan solid with a mild chemical odor. Considered moderately toxic.

5. ENDRIN - ($C_{12}H_8Cl_6O$) A quadruple-ring compound composed of two pentyl and two benzene rings, an isomer of dieldrin. Like dieldrin, endrin is a colorless to tan solid with a mild chemical odor. Considered highly toxic.

6. DDT (Chlorophenothane)* - ($C_{14}H_9Cl_5$) A double-ring structure with two unsaturated benzene rings, each with one chloride radical, joined by a chlorinated ethyl group. A colorless solid with a weak chemical odor. Considered moderately toxic.

7. Heptachlor* - ($C_{10}H_5Cl_7$) A triple-ring structure with one saturated benzyl and two saturated pentyl groups. This ring structure is the principal ingredient of heptachlor, which is a light tan, waxy solid with an odor similar to camphor. Considered moderately toxic.

8. BHC-mix (LINDANE)* - ($C_6H_6Cl_6$) An unsaturated flexed benzene ring with six chloride radicals. The compound is powdered as a mix of nine stereoisomers, only one of which (the y-isomer) has inset radical properties. The product is sold on the basis of the percent of the y-isomer and is a colorless solid with a musty odor (pure lindane, the y-isomer, is odorless). Considered moderately toxic.

* These pesticides are currently banned from U.S. markets. Lindane may no longer by used in continuous vaporizers, but is the active ingredient of many home and farm pest control agents. (EPA-54019-80-005, January, 1982).

Common Symptoms and Signs of Poisoning

Most organochlorides including the ones of concern on the site, are efficiently absorbed from the gut after ingestion or across the skin. In sufficient quantity, they interfere with nerve impulse transmission and disrupt nervous system functions, especially in the brain. This results in behavorial changes, disturbances of equilibrium and senses, involuntary muscle activity and depression of vital centers, especially those controlling respiration. Although the primary target is the CNS (Central Nervous System), other target organs include liver, kidneys, skin, eyes, and occasionally blood, lungs and PNS (Peripheral Nervous Systems).

Common symptoms are:

- apprehension
- excitability
- dizziness
- headache
- disorientation
- weakness
- convulsions
- unconsciousness
- tingling sensation in the extremities (parathesia)

Soon after ingestion, nausea and vomiting commonly occur. When absorbed through the skin, apprehension, twitching, tremors, confusion and convulsions may be the first symtoms. Respiratory depression is caused by the pesticides and the petroleum solvents in which they were dissolved. Pallor and cyanosis may result with moderate to severe poisoning.

Prognosis and Treatment

Although fatalities have occurred following absorption of large quantities of some organochloride pesticides, complete recovery is highly likely if convulsions can be controlled and vital functions curtained. Lindane, toxaphene and most constituents of chlordane (except hexachlor and oxychlordane) are excreted rapidly in humans (usually within 3-4 days of ingestion). Dieldrin, aldrin, endrin, and heptachlor are excreted within weeks to several months. DDT and BHC are excreted very slowly, requiring months or years for elimination.

Treatment consists primarily of keeping air passages free of excretions and, if necessary, pulmonary assistance with oxygen. Convulsions are controlled by such anticonvulsants as valium, and pentobarbital. Skin and hair are cleaned vigorously if contaminated and stomach and intestines are emptied if sufficent quantity of organochloride pesticide has been ingested. During convalescense, carbohydrates, protein and vitamins are enhanced in diet to minimize liver injury.

Exposure Limits and Physical Properties

The American Conference of Governmental Industrial Hygienists, Inc. (ACGHIH), has set two types of airborne concentration limits, TLV-TWA (threshhold limit value-time weighted average concentration for a 40-hour work week to which nearly all workers may be repeatedly exposed, day after day, without adverse effect) and STELS (a 15-minute time-weighted average exposure which should not be exceeded at any time during a work day and which should not be exceeded more than 4-time per day at intervals no shorter than 60 minutes) (ACGHIH for 1983-84). In addition, the U.S. Department of Health and Human Services and the U.S. Department of Labor have established IDLH levels (Immediately Dangerous to Life or Health) for use in NIOSH/OSHA evaluation of chemical hazards in the work place. These levels represent the maximum exposure level from which one could escape within 30 minutes without any escape-impairing symptoms or any irreversible health effects. These three levels are summarized in Table 1 for each of the eight pesticides suspected at the site.

Of these eight pesticides, only chlordane is normally liquid. The other seven compounds have melting points of at least 114^{o} F and range as high as 349^{o} F (for dieldrin). They are all either insoluble or very slightly soluble in water (0.001 to 0.00001%) in water, are not combustible (except for toxaphene, which has a flash point of 275^{o} F), and decompose upon boiling. Except for aldrin and lindane, which have no hazardous incompatibilities, all the compounds are incompatible with strong oxidizers. Dieldrin is also incompatible with active metals like sodium, strong acids and phenols. Endrin is incompatible with strong acids and melted heptachlor is incompatible with iron and rust.

Given the physical characteristics of the eight pesticides and the present admixture with site soils, significant volatilization of any of the organochloride pesticides at the site is highly unlikely. However, dermal contact with pesticides and soil/pesticide mixtures and aspiration of pesticide-contaminated dust are likely if adequate personnel protection and dust control are not provided for site personnel. Personal protection equipment, operations and training are discussed in Section 2.0.

Concentrations On-Site

At least three investigations have been performed at the pesticide dumping site (Area G, NWIRP):

- 1978 - preliminary sampling and analyses program conducted by the Navy
- 1981 - confirmed presence DDT and toxaphene and found aldrin/dieldrin, BHC-mix and heptachlor.
- 1983 - confirmed previous two analyses except that aldrin/dieldrin was not detected.

Figure 1 shows the location of the eighteen sample locations from 1982 and 1983, and the maximum total pesticide concentration found at each location. Table 1-2 lists the analytical results obtained during the 1982 and 1983 sampling period by pesticide for each location.

Concentrations range from a low of 1.6 ppm at location 4 to a high of 191,800 ppm at location 17. Removals of surface soils in visually contaminated areas will proceed from south to north to minimize recontamination of cleaned areas. Due to localized spots of extreme contamination, dust control at the site during operation is considered important. These and other site safety factors are discussed in Section 2.0.

2 - PERSONNEL PROTECTION

The personnel protection program for the project includes, provision of protective equipment, administrative control for personal hygiene, and training of employees working on the project.

2.1 Protection From Site Hazards

Workers will be protected from contamination by organochloride pesticide during remedial operations by a combination of protective equipment and operational procedures, including:

- Designation of exclusion, decontamination and support (clean) areas
- Respiratory equipment
- Protective clothing
- Safe personal hygiene practices
- Training in safety and emergency procedures
- Provisions for relief of heat stress

These procedures and equipment are detailed in the following subsections.

2.1.1 Equipment

Respiratory and personal protection equipment and clothing has been selected based on maximum measured soil pesticide concentrations (Table 2) and a maximum potential airborne dust concentration of 100 mg soil/m^3 air. (Table 3) and will correspond to EPA/TDWR Level C. All employees working within the project area will be issued safety equipment and protective clothing prior to initiating site investigation activities. The Health and Safety Officer will maintain a log of equipment issued to and returned by site personnel.

Respiratory Equipment

The selection of respiratory protection for removal operations at the site was based on the calculated maximum airborne exposure level possible at the site (Reference Table 2). This level proves to be 14.5 mg/m^3 for toxaphene, which

TABLE 2

Results of Chemical Analyses of Soils Performed
At The NWIRP Site

SITE #	DDT	TOXAPHENE	ALDRIN/DIELDRIN	BHC MIX	ENDRIN	HEPTACHLOR
August, 1982						
1	<0.050	<0.100	<0.010/<0.010	0.177	<0.010	1.7
2A	<0.050	**	<0.010/571	190	<0.010	<0.020
2B	<0.050	<0.010	<0.010/8.10	4.1	<0.010	<0.020
2C	<0.050	<0.100	<0.010/0.00	4.1	<0.010	<0.020
2D	<0.050	<0.100	<0.010/<1.5	2.8	<0.010	1.3
3	<0.050	<0.100	<0.010/18	<0.010	<0.010	<0.020
4	<0.050	<0.100	<0.010/0.50	1.1	<0.010	<0.020
5A	<0.050	32,000	<0.010/<0.0	1,200	<0.010	<0.020
5B	<0.050	**	<0.010/6.70	14	<0.010	<0.020
6A	467	**	<0.010/<0.010	11	<0.010	<0.200
6B	67	<0.100	<0.010/0.010	1.2	<0.010	<0.020
6C	<0.050	<0.100	<0.010/<0.010	<0.010	<0.010	<0.020
7A	<0.050	<0.010	<0.010/<0.010	3,000	<0.010	<0.020
7B	<0.050	**	<0.010/825	11,100	<0.010	<0.020
8	<0.050	<0.010	<0.010/2.1	4.4	<0.010	<0.020
September, 1983						
9	1.5	<0.100	<0.050/<0.050	2.2	<0.050	<0.050
10	30	<0.100	<0.050/<0.050	29	<0.050	<0.050
11	20	<0.100	<0.050/<0.050	25	<0.050	<0.050
12	18	<0.100	<0.050/<0.050	31	<0.050	<0.050
13	500	<0.100	<0.050/<0.050	1,000	<0.050	<0.050
14	25	<0.100	<0.050/<0.050	<0.100	<0.050	<0.050
15	26	<0.100	<0.500/<0.500	50	<0.500	<0.500
16	10	<0.100	<0.500/<0.500	6.4	<0.500	<0.500
17	<0.500	145,000	<0.050/<0.050	46,800	<0.050	<0.050
18	4,000	<0.100	<0.050/<0.0	<0.050	<0.050	<0.050

* Interference present after clean up.

** Present, unable to quantitate; Toxaphene fingerprint obscured by other pesticide peaks, DDT values include o,p DDT and p,p DDT.

TABLE 3

Summary of Maximum Site Concentration, Exposure-Limit Defined Respirator Selection and Personal Protection and Hygiene

Pesticide	Highest Observed Concentration in soil (ppm) (mg/kg)	Maximum * dust loading (100 mg soil/m^3 air)	Respirator Selection: Upper Limit (mg/m^3)	Respirator Selection: Devices Permitted	Personal Protection and Hygiene
Aldrin	none detected (ND) (suspected)	0	2.5	(1) Chemical cartridge (pesticide) respirator, dust & mist filter	Provide complete skin protection, Wash skin immediately upon contamination, change tyvek immediately upon visible contamination.
			12.5	(2) Fullface chemical cartridge respirator, pesticide cartridge, dust and mist filters	
			100	(3) Supplied air respirator, pressure demand	
			Escape	(4) Gas mask with pesticide filter, pesticide respirator	
Chlordane	suspected	unknown	5	(1)	Provide complete skin protection, (same as above)
			25	(2)	
			500	(3)	
			Escape	(4)	
Chlorinated Camphene (Toxaphene)	145,000	14.5	5	(5) Chemical cartridge respirator, pesticide cartridge	(Same as above)
			25	(6) Fullface chemical cartridge, pesticide cartridge	
			200	(7) Powered air-purifying respirator with pesticide canister	
DDT	4,000	0.4	10	(1)	(Same as above)
			50	(2)	
			500	(8) Fullface chemical cartridge respirator with high-efficiency filter, pesticide cartridge	
Dieldrin	825	0.08	2.5	(1)	(Same as above)
			12.5	(2)	
			250.0	(9) Powered air-purifying respirator with pesticide cartridge, full-face with a high-efficiency particulate filter	

*See next page

TABLE 3 (Continued)

Summary of Maximum Site Concentration, Exposure-Limit Defined Respirator Selection and Personal Protection and Hygiene

Pesticide	Highest Observed Concentration in soil (ppm) (mg/kg)	Maximum * dust loading (100 mg soil/m^3 air)	Respirator Selection: Upper Limit (mg/m^3)	Respirator Selection: Devices Permitted	Personal Protection and Hygiene
Dieldrin (con't)			450	(10) Fullface supplied air respirator, pressure demand	
			Escape	(4)	
Endrin	ND (suspected)	0	1	(1)	Provide complete skin protection, wash skin immediately upon contamination, change tyvek immediately upon visible contamination.
			5	(2)	
			100	(8)	
			200	(10)	
			Escape	(4)	
Heptachlor	1.7	.0002	5	(11) Supplied air respirator	(Same as above)
			25	(12) Fullface supplied air	
			500	(3)	
			700	(10)	
			Escape	(4)	
Lindane (BHC-mix)	46,800	4.7	5	(1)	(Same as above)
			25	(2)	
			500	(9)	
			1000	(10)	
			Escape	(4)	

* The maximum dust levels in Table 3 were calculated on the basis of the following worst-case conditions:

1) The maximum concentration of each pesticide found in soil samples analyzed for the 1982 and 1983 investigations (Figure 1, Table 2).
2) A maximum potential particulate concentration of 100 mg soil per m^3 of air (0.1 g/m^3)

The calculated maximum airborne exposure would then be given by the formula:

$$\frac{\text{[pesticide in soil] in mg/kg}}{10^4} = \text{[pesticide in air] in mg/m}^3$$

For Example: Toxaphene Max. [Toxaphene] soil = 145,000 mg/kg = 145 g/kg = 0.145 g Toxaphene /g soil

Therefore, 0.1 g soil/m^3 air x 0.145 = 0.0145 g/m^3 = 14.5 mg/m^3 [toxaphene] air requires use of a full face chemical cartridge respirator with a pesticide cartridge. To provide further protection and guard against exposure to potentially high soil concentrations all workers will also be provided with high efficiency dust and mist filters.

This respiratory equipment is to be worn at all times by the backhoe operator, and the two ground-based SWCI hazardous waste specialists present during loading and scraping operations. Truck drivers will park their trucks with the windows closed and leave the site during loading operations.

Protective Clothing

In addition to the full-faced respirators described above, the minimum protective equipment that is required to be worn by all personnel entering the designated work zone follows:

- Tyvek full body disposable coveralls with hood. Tyvek should be taped closed over gloves and boots and hood should be secured over head and hair.
- Rubber boots or boots with rubber overshoes
- Plastic surgical gloves with PVC outergloves.
- Cotton underwear or surgical gowns (with pants), socks.

This level of protective clothing is required in order to minimize the potential for direct contact with the contaminated soil, as recommended by NIOSH (Reference Table 2).

2.1.2 Safety Practices

To prevent injuries and acute and chronic health effects, the following safe work practices will be followed on-site. These practices establish a pattern of general precautionary measures for reducing the risks associated with worksite operations.

Heat Stress

Working in the required protective clothing and in Texas' summer, can cause problems with heat stress unless proper precautions are taken. Serious medical difficulties can arise from overstressing the body when personnel are initially introduced to the heat without gradual acclimatization, and/or work without adequate frequent, short rest periods.

Workers will be informed of the serious dangers of the body being overstressed and how to monitor themselves and their fellow workers for symptoms of heat exhaustion and heat stroke. When a worker recognizes symptoms in himself or a fellow worker, the Health and Safety officer will be notified immediately. The worker will concurrently be escorted out of the "hot" zone to a shaded portion of the decontamination area where the protective clothing can be removed. Water should be drunk and a period of rest provided. Depending on the severity of the workers condition, he/she may need to be artificially cooled off by applying water externally and rapid fanning, and further medical attention provided. An accident report will be filled out by the Health and Safety Officer and submitted to the Project Manager.

To help mitigate heat stress, the removal operation schedule has been designed to avoid the hottest portion of the day (1:00 p.m. to 5:00 p.m.). The schedule is as follows:

Day 1 - Morning Shift - 6:30 a.m. until Noon. Trucks 1 and 2 will arrive at 7:30 and 9:30. Load both trucks, weigh, secure loads and dispatch.

Day 1 - Evening Shift - 5:00 p.m. until 9:00 p.m. trucks 3 and 4 will arrive at 5:30 and 7:30 p.m. Load, weigh, secure, and dispatch the trucks.

Day 2 - Morning Shift - 6:30 a.m. until 1:00 p.m. Trucks 5, 6 and 7 will arrive at 7:00, 9:00 and 11:00 a.m. Load, weigh, secure, and dispatch trucks. Decontaminate backhoe bucket and tracks. Place contaminated gloves, booties and coveralls in Truck 7 trailer.

Day 2 - Afternoon - Demobilize

<u>Personal Hygiene</u>

The following procedure will be practiced by all SWCI, Sprint or observing personnel entering the contaminated area of the site:

1. Eating, drinking, chewing gum or tobacco, taking medication, and smoking is prohibited in the contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.

2. Upon leaving contaminated or suspected contaminated areas, boots must be thoroughly washed and protective clothing removed and discarded in a designated trash bag. Then, the hands and face must be thoroughly washed. After decontamination procedures, a thorough shower and washing of the body will be undertaken at facilities provided by Hercules.

3. Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on trucks, equipment or ground. Do not place equipment on potentially contaminated surfaces.

4. No beard or facial hair which interferes with a satisfactory qualitative respirator fit test may be worn.

The site Health and Safety officer will perform inspections and document variations. Violators will be removed from the job site.

Personnel Protection

1. Be familiar with and knowledgeable about standard operating safety procedures.

2. Be familiar, knowledgeable and adhere to all instructions in the site safety plan.

3. Be familiar with arrangements for emergency medical assistance. The location, telephone number and transportation capabilities of the nearest emergency medical facilities are provide in Section 5.

4. Consider fatigue, heat stress and other environmental factors influencing efficacy of personnel.

5. Wear appropriate or designated, approved respiratory protective devices and protective clothing.

Operations and Communications

1. In emergencies, oral safety protocols must be established by the team consistent with the site safety plan.

2. SWCI and Sprint personnel going on-site are to be thoroughly briefed on the anticipated hazards, equipment requirements, safety practices, emergency procedures and communication methods.

3. Normal entrance and exit routes are through the decontamination area shown in Figure 1 and then 10 feet parallel to the edge of the road. Emergency escape routes will consist of exiting by the shortest route to the access road and then to the decontamination area for assistance.

4. Unfamiliar operations will be rehearsed prior to implementation.

5. Personnel on-site will use the "buddy" system (pairs). "Buddies" pre-arrange hand signals or other means of emergency signals (i.e., truck horn) for communications. The backhoe operator will also communicate directly with the site Health and Safety officer.

6. Visual contact is maintained between "pairs" on-site with the team members remaining in close proximity in order to assist each other in case of emergencies.

7. Wind indicators visible to all on-site personnel will be provided to indicate possible routes to upwind escape.

8. The number of personnel and equipment in the contaminated area will be minimized consistent with site operations.

9. Appropriate work areas for support, contamination reduction and exclusion will be established the day before removal operations begin.

10. Appropriate decontamination procedures for leaving the site are established, as discussed in Section 3.

2.2 Training

The Health and Safety Officer or his designated agent will train all employees prior to their working on the site. Training will include:

- Requirements for employees to work in pairs
- Buddy system including backhoe operator
- Proper materials handling
- Preventive maintenance of safety equipment
- Requirements for and use of respirators and personal protective equipment
- Required personal hygiene practices
- Heat stress
- Effective response to any emergency
- Responses to fires and explosions
- Shutdown of operations
- Emergency procedures
- Areas of the site that have restricted access
- Methods used for decontamination, and
- General safety precautions.

A log of site personnel having completed this training will be maintained by the Health and Safety Officer.

3 - DECONTAMINATION PROCEDURE

A waste site generally involves the escape or potential escape of normally controlled substances into the environment via air, water or land surfaces and site activities involved control actions to prevent, minimize and remove these substances. As used here, however, site control is preventing or reducing the transport of hazardous substances (contaminants) from the site by workers and equipment involved in site operations.

Site control involves two major activities: (1) physical arrangements and control of the site work area; and (2) methods for the removal of contaminants from people and equipment - decontamination procedures - which are discussed in Section 3.1 and 3.2.

Control of contaminants is needed to reduce the possibility of transfer from the site of contaminants, which may be present on personnel and equipment needed for various on-site operations. This can be accomplished in a number of ways including:

1. Physical barriers to exclude unnecessary personnel.
2. Checkpoints with limited access to the site or areas within the site.
3. Minimizing personnel and equipment on-site consistent with effective operations.
4. Establishment of containment zones.
5. Decontamination procedures.
6. Conducting operations in a manner to reduce possibility of contamination.

One method of reducing the potential for transfer of contamination off-site is to delineate zones or work areas based upon expected contamination. Within these zones prescribed operations would occur utilizing appropriate personnel protective equipment. Movement between areas would be controlled at checkpoints. Three contiguous zones are recommended:

1. Exclusion area (contaminated);
2. Contamination reduction area;

3. Support area (non-contaminated).

Exclusion Area

The exclusion zone is the inner most area of three concentric "rings" and is considered contaminated, dirty or "hot." Within this area prescribed levels of protection must be worn by any entering personnel. An entry checkpoint must be worn by any entering personnel. An entry checkpoint must be established at the periphery of the exclusion area to control the flow of personnel and equipment between contiguous zones and to ascertain that the procedures established to enter and exit the zones are followed. The exclusion area boundary would be established initially based on the presence of the actual wastes or visual evidence of spilled materials.

Support Area

The support area is the outermost of three rings and is considered a non-contaminated or clean area. It contains the command post for field operations and other elements necessary to support site activities. Normal street clothes are the appropriate apparel within this zone.

Contamination Reduction Area

Between the exclusion area and the support area is the contamination reduction (decontamination) area. The purpose of this zone is to provide an area to prevent or reduce the transfer of contaminants which may have been picked up by personnel or equipment returning from the exclusion area. All decontamination activities occur in this area.

The boundary between the support area and the contamination reduction area is the contamination control line. This boundary separates the possibly contaminated area from the clean zone. Entry into the contamination reduction zone from the clean zone. Entry into the contamination reduction zone from the clean area should be through an access control point. Personnel entering at this station would be wearing the prescribed personal protective equipment for working in the contamination reduction area. Exiting the contamination reduction area to the clean area requires the removal of any suspected or known contaminated personnel protection equipment and compliance with decontamination procedures.

At the boundary between the contamination reduction area and the exclusion area is the "hot line" and access control station. Entrance into the exclusion area requires the wearing of the prescribed personal protection equipment. A personnel decontamination station is established for those exiting the exclusion area. A separate area for decontamination of trucks and backhoe will be established near the personnel decontamination zone.

The use of a three-zone system of area designation, access control points and exacting decontamination procedures provides reasonable assurance against the translocation of a contaminating substance.

The location of the Field Command Post and other support necessities in the support area (clean zone) are dependent on a number of factors including:

1. Wind direction - Preferably the Command Post should be located upwind of the site exclusion area. However, wind directions shift and other conditions may be such that the ideal location based on wind direction does not exist. In this case, the decontamination area has been located in the least contaminated area of the site and closest to the egress route from the site.

2. Accessibility & Proximity to Site - The Command Post will be placed along the road near the site for immediate access.

3.1 Equipment Decontamination

Four major types of heavy equipment will be used during removal operations at the site. These include 1) Seven 18-wheeled truck trailer, each with a payload of 24 tons and a total length of 35 feet; 2) a small crawler type backhoe with a smooth bucket capable of excavating to a controlled depth, 3) a set of portable truck scales, and 4) scaffolding used to place trailer cover over the truck beds after closure of the plastic liners.

3.1.1 Trucks

Excavation by the backhoe will be made directly into the bed of the waiting truck trailers. The trailer beds will be lined with a heavy duty totally enclosed plastic liner. Utilization of this liner will preclude any further decontamination of the trailer beds. A total of 165 tons (approximately 122 cubic yards) of waste will be excavated. Using eighteen wheeled truck trailers, payloads of 24 tons per unit are expected with a total of 7 truck loads.

Empty and fully loaded weights will be measured by a portable on-site scale. This will insure that the truck does not exceed allowable weight restrictions. Using a scale on-site precludes any potential contamination at neighboring scales.

After the truck weight has been checked and found correct, the plastic liner will be closed, encapsulating the waste. Then the trailer cover will be placed over the bed, providing further protection.

Any visible soil or dust on the truck/trailer body and tires will be washed off with a high-pressure water hose. Each unit will be appropriately placarded.

Disposal

Each of the seven truck units will proceed directly to the Chemical Waste Management secure hazardous waste landfill at Emelle, Alabama for disposal. The contaminated soil, plastic liners, and disposable personnel protective equipment will all be disposed in the landfill.

3.1.2 Backhoe

At the end of each work shift, the backhoe and operator will return to the decontamination area where the machine will be parked until the next shift. If the backhoe does not have an enclosed, air conditioned cab, the interior of the cab will be thoroughly wiped to remove any visible dust accumulated during excavation. At the completion of all removal operation, the backhoe will be thoroughly washed using a high-pressure water hose to remove all visible dust and dirt from chairs and tracks. If the cab is not enclosed, it should be thoroughly cleaned to remove all visible dust and/or boot-carried dirt or mud. After thorough washing, the backhoe will be released from the site.

3.1.3 Scales and Scaffolding

After completion of all site activities, the portable truck scales and scaffolding used to line the truck trailers should be thoroughly washed with high-pressure water. After washing, the equipment may be dismantled and loaded for removal from the site.

3.2 Personnel Decontamination and Respirator Maintenance

After completion of each shift personnel should proceed to the personnel decontamination station. Decontamination will consist of the following sequence of action:

- Remove respirator
- Thoroughly wash exposed portion of boots with water. If the site is muddy, a wash tub with soapy water and a scrub brush will be provided in addition to prearranged water.
- Untape sleeve and pant legs, remove outer gloves, then remove Tyvek suit and boots. Dispose of suit and gloves in designated trash bag.
- Advance to wash station and thoroughly wash hands and forearms with soap and water, then wash face and neck.
- Proceed to water station in clean zone and/or to shower provided by Hercules.

All discarded protective clothing will be collected and loaded into the last truck for disposal at the Emelle, Alabama facility. Arrangements have been made with Hercules, the current site operator, to provide shower facilities for all personnel upon site exit and/or emergencies.

Respirators will be inspected before and after each use and those respiratory protective devices not in routine use at the site will be inspected at least weekly. The manufacturer's time limits for the use of respirator cartridges and filters exposed to measurable contaminant levels will be followed. Respirator cartridges and filters that have exceeded their period of use will be replaced.

Routinely used respirators will be collected, cleaned, and disinfected to help assure proper protection. The Health and Safety Officer or his designated assistant will maintain the respirators. If, in the cleaning or inspection of the respirators by the users, broken or nonfunctioning parts are discovered, a replacement part or a new respirator will be issued. Respirators will be stored in an area where they will be protected against damage by dust, heat, extreme cold, excessive moisture, or damage by chemical contact. The storage area for the respirators will be in a readily accessible location within the site and all personnel will be made aware of the location.

4 - CONTAMINANT MIGRATION CONTROL

4.1 Perimeter Controls

The site is located within Area G at the NWIRP - McGregor, Texas Navy facility (Figure 1). The contaminated areas located in the far west side of Area G, which is a hexagonal piece of property totally enclosed by a fence. Access to the area is limited to personnel from Hercules (the current site contractor) and the U.S. Navy. Furthermore, access to the NWIRP facility is controlled. Therefore, no additional access controls on the contaminated area are deemed necessary.

4.2 Dust Control During Removal Operations

As previous discussed, the only likely pathway for respiration of pesticides at the site is via direct aspiration of contaminated dust. In order to minimize the potential for this pathway, SWCI has made provisions for a portable truck-mounted pressurized water tank to spray water on exposed soils to control dust emissions during removal operations. This water source will also be used to wash truck tires and chassis in the decontamination area prior to departure from the site. Operations will be suspended during high wind conditions i.e., when control of visible dust cannot be maintained by sprinkling with water and/or during or before forecasted extreme weather conditions, such as tornadoes.

These measures should significantly reduce airborne dust levels below the 100 mg/m^3 maximum expected at the site.

4.3 Wash Water Control

The decontamination area will be established at the far northern end of the contaminated area, where current levels of contamination are believed to be less than 5 ppm (soil). All wash water from the heavy equipment wash area and the personnel wash area will be disposed of on-site and will not be allowed to run to the support area ("clean area") or to the access road ditch. The total amount of pesticides in the wash water is expected to be small and should not constitute a significant addition to soils in the decontamination area.

Two additional measures will be included in site operation practices to minimize water-borne egress of contaminants from the site.

- All excavation and loading operations will cease immediately in the event of heavy rainfall during operation. Truck and backhoe will be removed to the decontamination area and the liner in the truck will be sealed for the duration of the storm.

- No removal operations will be initiated after a heavy rainfall until surface conditions have returned to a workable state (i.e., damp but not wet or puddled). This strategy will reduce both surface disturbance of bare and vegetated soils and substantially reduce the amount of contaminated soil that could potentially be transported via wheels, treads and boots to the decontamination area.

5 - EMERGENCY RESPONSE PLAN

The Health and Safety Program for the site removal actions has been established to allow site operations to be conducted without adverse impacts on worker health and safety. In addition, supplementary emergency response procedures have been developed to cover extraordinary conditions that might possible occur at the site.

5.1 General

All accidents and unusual events will be dealt with in a manner to minimize continued health risk of site workers. In the event that an accident or other unusual event occurs, the following procedure will be followed:

- First aid or other appropriate initial action will be administered by those closest to the accident-event. This assistance will be conducted in a manner to assure that those rendering assistance are not placed in a situation of unacceptable risk.

- All accidents/unusual events must be reported to the Site Manager. For this project the Site Manager and Health and Safety Office will be the same individual. The Site Manager is responsible for conducting the emergency response in an efficient, rapid, and safe manner. The Site Manager will decide if off-site assistance and/or medical treatment is required and arrange for assistance.

- All workers on site are responsible for conducting themselves in a mature, calm manner in the event of an accident/unusual event. All personnel must conduct themselves so as to avoid spreading the danger to themselves and to surrounding workers.

The following emergency equipment will be available at the site:

- First aid kit
- Fire extinguisher and blanket
- Emergency eyewash station.

5.2 Worker Injury

If an employee working in a contaminated area is physically injured, Red Cross first aid procedures will be followed. Depending on the severity of the injury, emergency medical response may be sought. If the employee can be moved, he will be taken to the edge of the work area where contaminated clothing will be removed and any emergency first aid administered. The worker will then be transported to a local emergency medical facility by way of the NWIRP ambulance.

If the injury to the worker is chemical in nature (i.e., overexposure), the following first aid procedures are to be instituted:

- Eye Exposure - If contaminated solids or liquids get into the eyes, wash eyes immediately at the emergency eyewash station using large amounts of water and lifting the lower and upper lids occasionally. Obtain medical attention immediately.

- Skin Exposure - If contaminated solids or liquids get on the skin, promptly wash the contaminated skin using soap or mild detergent and water. Obtain medical attention immediately if exposure to concentrated solid is suspected. Wash face and hands prior to eating or leaving the site.

- Breathing - If a person breathes in large amounts of contaminants, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Obtain medical attention as soon as possible.

- Swallowing - When contaminated solids or liquids have been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Obtain medical attention immediately.

5.2.2 Fires

Fire extinguishers will be provided with the heavy equipment. If a localized fire breaks out, chemical fire extinguishers will be used to bring the occurrence under control. If necessary and feasible, a fire blanket, soil, or other inert materials will be placed on the burning area to extinguish the flames and minimize the potential for spreading. If appropriate, local fire-fighting authorities will be contacted for notification and/or assistance.

If an uncontrolled fire develops the Site Manager or his designated assistant will alert the NWIRP Fire Department.

5.3 Unusual Objects or Events

Although highly unlikely, unusual objects (i.e., gas cylinders, bulging drums, fuming containers) could be encountered during removal operations. If such objects are encountered, the Site Manager will halt operations and notify the Project Manager. The Project Manager will contact TDWR to decide on the next course of action. The Site Manager is responsible for suspending site operations in the event of heavy rainfall.

5.5 Spills

Handling procedures have been developed to limit potential problems with material spillage. In the event of a spill of contaminated soil at the site, the area will be isolated from traffic patterns by the Health and Safety Officer. Spilled solids will be removed using the backhoe and loaded into a truck for subsequent disposal. No liquid spills are anticipated at the site.

5.6 Emergency Horn Signal

All personnel will be informed of an emergency situation which requires suspension of site operations; egress from the work area; emergency responses; and if necessary, site evacuation via continual long horn blasts as defined during employee training.

5.7 Notification and Documentation

Checklist

The names and phone numbers of all personnel and agencies that could be involved in emergency response will be established by the Site Manager and posted at several prominent locations at the site (Table 4).

Procedures

In the event of an on-site emergency requiring notification of off-site personnel, the Site Manager is responsible for immediately notifying the agencies and personnel listed in Table 5-1. If for some reason the Site Manager is unavailable, his designated assistant must perform this function. The designated TDWR representative will be apprised of the contact of an agency or person listed in Table 4 as soon as possible after the contact is made.

Documentation

The Site Manager will provide a report to the Project Manager describing the following:

- The event (including date and time) that necessitated the notification and the basis for that decision.

- Date, time, and names of all persons/agencies notified and their response.

- Resolution of the incident (including duration) and the method/corrective action involved.

This report will be submitted within five working days of the resolution of the event.

5.8 Evacuation Plan

Although very unlikely, it is possible that a site emergency could necessitate evacuating all personnel from the site. If such a situation arises, the Site Manager will give the appropriate signal for site evacuation. It is the responsibility of all individuals to evacuate in a calm, controlled fashion.

TABLE 4

NOTIFICATION CHECKLIST

The event of a fire, uncontrollable chemical spill, explosion, severe earthquake, or any occurrence that might be damaging personnel or adjacent property will require the immediate notification of the proper emergency service. The proper emergency service is determined by the nature of the emergency.

EMERGENCY OR DISASTER NOTIFICATION PROCEDURE

Fire Department, Ambulance & Plant Security..Plant Phone 1222

PROCEDURE FOR REPORTING ACCIDENTS

IMMEDIATELY CALL: (1) In Plant Emergency Number 1222 and/or
(2) D.S. Diehl
(713) 789-6652 (work)
(713) 492-0727 (home)

In case of an emergency situation subsequently contact:

Ann McGinley (512) 475-5516 (TDWR)

After notification of the proper emergency service or services, proceed to deal with the emergency at hand. It is reasonable to believe that any emergency or disaster will involve fire or major find of buried wastes or both.

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